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BRITISH METHODS OF TRAINING  
WORKERS IN WAR INDUSTRIES



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U. S. DEPARTMENT OF LABOR  
TRAINING AND DILUTION SERVICE  
C. T. CLAYTON, Director  
618 Seventeenth Street, Washington, D. C.

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BULLETINS UPON TRAINING AND DILUTION  
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### INTRODUCTION.

With a shortage of skilled labor, especially in the machine trades but reported in practically all essential lines to threaten if not seriously to hamper production of the supplies which our Army and Navy must have, the possibilities have been considered of training more workers, either boys, older men, men rejected for military service or given deferred classification because of dependents; or women, if these accustomed sources of supply fail.

How such training may be best organized and conducted may perhaps be learned from the British, who have been training on a wholesale scale. The five instructional factories operated by the British Ministry of Munitions turn out 800 operatives, largely trained to be instructors, every six weeks. The technical schools operating in conjunction provide 500 a week, and have trained more than 50,000 in all. But the vestibule training departments of the manufacturers themselves, with the cooperation of the trade-unions, have trained more than ten times as many as all the Government agencies together. How this has been done is hinted at in the following pages, made up mainly of extracts from British publications.

### WAR LABOR PROBLEMS.

In April 1915, after eight and a half months of war, it was announced that Mr. Lloyd George would head a board "to organize the national output of munitions of war," and about a month later, at the time of the formation of the coalition cabinet in May, 1915, a ministry of munitions was created, with Mr. Lloyd George as its chief. A munitions bureau was organized; all factories making war material were placed under control of the Government; skilled workmen at the front were recalled to work in munition plants; men in the colonies and in the United States, experienced in the making of munitions, were offered free transportation to England; a suspension of union rules was urged, and finally, in June, 1915, the munitions of war act was passed.

This bill prohibited strikes and lockouts in war industries, substituted compulsory arbitration, and suspended all trade-union rules "calculated to hamper production." On the other hand, as a concession to labor in recognition of the sacrifices the workers were making, the profits of employers were limited, and excess amounts reverted to the national treasury.

Provision was also made under the act for recruiting among trade-union members, by the unions themselves, a "voluntary army of workmen" who would sign agreements to work wherever their labor was needed. The existing local munitions committees were transformed into labor courts, with power to fine individual workmen for "sacking," for infraction of the agreements signed by them as members of the "voluntary army of workmen" and for any offenses tending to "hamper production," and with the further power to make decisions in regard to changes in existing wage rates.

By this time workers on munitions saw themselves stripped of all rights and safeguards that had been theirs in time of peace. Confusion reigned in the industry. In the first burst of patriotic fervor, everything had been sacrificed to speed; labor laws had broken down; excessive hours of work prevailed. Thousands of women, many of them totally unaccustomed to factory work, had taken up the tasks of men who were fighting. Employers, taking advantage of the fine spirit in which the women offered their labor to the nation, were in many cases paying very low wages. Labor unions were dissatisfied with the setting aside of their rules, and especially with the so-called "dilution" of labor. The country fairly seethed with threatened and active labor disturbances.<sup>1</sup>

The ministry of munitions found itself confronted with threatened war at home while engaged in mobilizing the national power to face the foe across the Channel. Common understanding must be secured and a basis of working be adopted. Such a basis was found.

The British method of coping with the problem of labor unrest during the war has been through conferences attended by representatives of the labor unions, the employers, and the Government. Such a conference in March, 1915, resulted in the "Treasury Agreement," which later was embodied in the munitions of war act of July 2, 1915. That act covered practically every relation of labor to things manufactured for war purposes.

Features of the Treasury Agreement were as follows:

1. The minister of munitions was empowered to control all factories engaged principally in war work, his power extending to the right to take the plant over in the event of mismanagement. Up to the close of 1917, there were only two or three instances of this right being exercised.

2. Power was given to limit the profits of factories to an increase of 20 per cent above the average profits for the two preceding years.

3. The wages of employees were fixed as of March, 1915. Any variation must be with the consent of the minister of munitions.

4. The committee on production was established to meet at least three times a year and hear evidence on the cost of living. If the cost was found to have increased, employers were ordered to pay a bonus to their workers, which advance was later repaid by the Government.

5. Strikes became illegal; arbitration compulsory.

Britain quickly obtained a control of every factory by putting into effect a system of licensing and priority laws. If a manufacturer, normally using material necessary for war work, wanted additional supplies he was obliged to apply for a license. If he wanted the supplies for non-essential work, the license was refused. This brought the plants into war work or obliged them to shut down. In the early days of the war, voluntary enlistment in the army took many skilled mechanics away from the shops, thus cutting down materially the producing ability of the manufacturing plants of the country. As a result, when a manufacturer found that he had taken on more orders than he could fill with the amount of labor readily available, he recruited labor from near-by factories. This led to two regulations under the defense of the realm act, namely:

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<sup>1</sup>Munition Workers in England and France, by Henriette R. Walker, Russell Sage Foundation, New York City.



1. No employer in the engineering industry (machine shops) and other plants should endeavor to entice any employee from any other employer in that industry.

2. The ministry of munitions was empowered to regulate and restrict the employment of labor in any factory.<sup>1</sup>

Among the unusual developments in the English labor situation, two may be mentioned to illustrate war-time expedients:

At Lord Kitchener's suggestion, arrangement was made with the dock laborers' union that a certain number of their members should join the army, not for military purposes but in order to be able to go 10 to 20 miles away from Liverpool in order to assist in unloading vessels.

Subsequently a local committee consisting of representatives of the War Office, the Admiralty, the port of London, and labor was formed and these four men had to be consulted before either one man or 10,000 could be transferred from London to an outlying port. Such workers wore the King's uniform, received their pay as soldiers, also civilian's pay and double pay for Sunday.<sup>2</sup>

The ministry of munitions ironed out many labor difficulties, and has now become an enormous institution, and the portion of its activities with which this Bulletin is concerned has been administered by the civil division of the labor supply department, under two sections; one upon training, and the other first known as the Dilution and Allocation Section.

The expedients adopted to deal with the shortage of labor were the dilution of skilled labor and the substitution of women for men.

Employers brought unskilled workers, men and women, into their plants, put them on easy jobs, promoted the men on the easy jobs to more skilled work, and in turn promoted those they succeeded.

A case that occurred recently may be mentioned as an example of the process. A steel plant in Wales had put up some new furnaces, and the ministry was unable to supply sufficient skilled or unskilled men to operate them. Sixty-seven women were employed. They did not work the furnaces, but they replaced a corresponding number of laborers in the plant in wheeling, unloading, and loading bricks and other material. The laborers so released were put on the lowest skilled jobs in the plant, replacing fourth-hand melters and mixers, who were promoted to be third-hand melters and mixers, and so on, until a full staff had been created for the new furnaces.

Another system operated to confine the skilled man to the work which only a skilled man can do. If a skilled mechanic normally had been on a job which could be split up into two or three parts, he was confined to the part of the job requiring the higher skill.

#### ORGANIZATION OF THE DILUTION SERVICE.

In May, 1918, the ministry of munitions established three labor departments, called the "L group," with Sir Stephenson Kent, K. C. B., as council member and C. S. Hurst, secretary officer. The group included the Labor Regulation Department, the Labor Adviser's Department, and the Labor Supply Department.

<sup>1</sup>Data taken from statements made to the Industrial Bureau of the Merchants' Association by the British Committee from the ministry on munitions.

<sup>2</sup>See U. S. Senate Document No. 84.

"Training and dilution and allocation" is classified under Labor Supply, Division A (Civil), T. M. Taylor, C. R. E., director. The training subdivision is under the direction of J. Currie, C. M. G., associated with W. T. H. Walsh and J. L. Hall.

The dilution and allocation subdivision was in August, 1918, divided into four subdivisions: Divisional Dilution and Distribution, Mr. Hanbury; Labor Supply (technical advice), Mr. Baillie; Control Dilution and Distribution, Nelson Wright; Embargoes and Levies, Mr. Penly.

The director of the Divisional Dilution and Allocation Section is responsible for the work allotted to the chief dilution officers and their staffs.

The director of the section on labor supply (technical advice) is responsible for exhibits and photographs; publications on dilution; records of dilution in individual firms, and in different industries, products, and processes, and the supply of information on request in regard to such dilution; issue of information about dilution to assist dilution officers; giving information and assistance on technical matters to any officer of the Labor Supply Department.

The director of the Control Dilution and Distribution Section is responsible for records of demands for labor made by or on behalf of firms; adjudication on demands for building labor; allocation to national priority and issue to chief dilution officers of directions to guide them in allocating local priority; records of supply of labor; initiation of any special action to supply labor; initiation and consideration of any special action to further dilution; collection of information of relative priority of products and material changes of program; arrangements with trade-unions, and other trade-union matters affecting dilution, and its issue to other sections; supply of information on request as to the labor position of individual firms or groups of firms; trade disputes arising out of dilution, and their reference to the chief labor adviser's department, and the supply of information in regard to them.

The director of the section on embargoes and levies is responsible for initiating action on embargoes or licenses; adjudicating on recommendations for embargoes; issue of embargo letters and control of the labor affected by the embargo; joint initiation of levies with director of the Control Dilution and Distributing Section, and the issue of directions to the chief dilution officers, to guide them in giving effect to levies.<sup>1</sup>

### SOURCES OF RECRUITING WORKERS.

With the formation of the Dilution organization, the way was open for the large scale introduction of women into industry.

A large number of women came from Ireland and Scotland in answer to the call of the Government. Some of them had been employed previously as domestics or as farm laborers; some as dressmakers, milliners, or store clerks.

Successful women workers have come from leisure homes; many have been artists or teachers. Their ages are between 18 and 35.

A soldier's wife from Rhodesia entered a London training school and soon became one of the best advanced workers. She is now setting tools.

A maintenance allowance of from \$1.55 to \$2.55 a week is paid

<sup>1</sup> Department Office Notice No. 148, British Ministry of Munitions, August 8, 1918.

approved full-time learners from the day of their entrance; cap and overalls are provided; and a woman supervisor is in charge.

Another source of influx has been the labor exchanges.

In the spring of 1916, the University of London and other colleges cooperated with the Board of Trade, and students were engaged for employment during vacations from two weeks to three months of the year.

## FORMULATION OF TRAINING POLICY.

In the first 18 months of the war more than four million men volunteered for the front. With so many men taken out of industry the Government informed trade-union leaders and executives of every trade and industry that women must go into work from which previously they had been excluded. The unions agreed to have unskilled men and women trained for the period of the war.

The unions, however, protected themselves in this respect. The printers, for example, insisted that before any woman could be introduced into the industry it must be made clear that male labor could not be obtained, and later entered into a specific agreement with the Government regarding war training measures. This agreement, which is typical of the trade-union protective measures, follows:

### I. GENERAL AGREEMENT.

As a result of a series of conferences with representatives of the Federation of Master Printers and Allied Trades of the United Kingdom and the Printing and Kindred Trades Federation, held at the Home Office under the chairmanship of Mr. G. Bellhouse, H. M. Superintending Inspector of Factories, the following general agreement was settled at a joint conference on the 21st of July, 1916, and finally signed on the 21st of August.

1. During the period of the war, and for such subsequent period as may be necessary to enable the unions to supply labor, the unions agree to such suspension of trade rules and customs as may be necessary to secure the carrying on of the trade, but subject to the conditions enumerated in the later paragraphs of this agreement.

2. This agreement shall come into operation only when or for so long as the individual unions are unable to supply labor. It shall be regarded purely as a war emergency, and prewar conditions shall be reverted to when the war is over.

3. Every employee leaving his employment to join His Majesty's forces shall be guaranteed—

(a) Reinstatement in his ordinary occupation where at all possible and if he is in a position to satisfactorily discharge his duties; and

(b) The wages he had when he left, plus any general advances or less any general reductions which may have taken place in his absence in his branch area.

4. Where women are introduced to take the place of men, preference shall be given to those women already in the trade.

5. If any employer should, through shortage of work, find it necessary to reduce the staff in any department, it shall be incumbent upon him to dispense first with any female or other substituted labor that may have been introduced to take the place of males.

6. Questions of remuneration and other details under this agreement shall be settled between the employers or their local associations and the branches or national executives of the unions concerned.

7. Any cause of dispute arising under this agreement shall, at the request of either side, be referred for arbitration to a committee consisting of not more than five representatives of the unions concerned (the number of representatives to be fixed by agreement) and such committee shall have power, if necessary, to appoint a referee to decide any point on which they are unable to agree, whose decision shall be final and binding upon both parties.



8. Nothing in the agreement shall be taken advantage of by either side to alter the relations existing prior to the war between the employers and the unions in any district.

With trade-union objections satisfied, classes for training women were instituted at various technical schools in all parts of the country, and invitations were extended to men and women to attend these classes, where they were trained particularly in the branch of industry in which their work was most essential. Skilled men in the factories were also chosen to train groups of unskilled men.

The best return has been from instruction given in the technical classes.<sup>1</sup>

The early idea of the British Government and the British public seems to have been to train war workers in existing schools, simply enlarging classes and providing free instruction when necessary. The first expansion took the form of organizing classes in the factories, to be taught by a teacher from one of the schools.

Women were registered at Board of Trade labor exchanges, to find out what reserve force of woman labor, trained or untrained, could be made available if required.

In October, 1915, the clerical and commercial occupation committee was appointed by the Home Office to consider training women for commercial and industrial occupations. This committee arranged with the London County Council and Local Education Committee for emergency training courses all over England and Scotland for general clerical work, bookkeeping, and office routine. The courses lasted from three to ten weeks, and the age of the students ranged from 18 to 35 years. Firms engaged in the grocery, boot, and lens-making trades took up the work and arranged for free courses lasting six weeks.

The London Society for Woman Suffrage found a great shortage of oxy-acetylene welders for aircraft work. A school was started with six women pupils and a woman instructor. As a result 220 welders were trained and placed by this one school the first year.<sup>2</sup>

Since then women have been introduced into industry in large numbers, and are engaging in highly technical work. A fair illustration of the accuracy that is habitually required in a large volume of work is to be seen in the final gauging and inspection of a screw gauge for a fuse, in which the women inspectors were described as examining these screws by an optical projection apparatus magnifying fifty times, with the help of which the inspector notes the defects in size and form and the necessary correction.

### GOVERNMENT TRAINING METHODS.

The British Ministry of Munitions has organized two classes of training establishments; first, training schools attached to technical colleges existing in most industrial centers; and, second, factories taken over by the ministry, which have been equipped as instructional plants. Actual munition work is done in these training establishments. No attempt is made to give general training, but specialized training on a specific type of machine is given, and in that way a considerable degree of skill within narrow limits is acquired in about six to eight weeks.

<sup>1</sup> Senate Document No. 84, June 30, 1917, p. 50.

<sup>2</sup> Women in Munitions, by G. Arnold Shaw.

The ministry of munitions thus describes the introduction of training:

When the magnitude of the munition problem became apparent, it was at once obvious that every possible source of labor must be tapped. Thousands of men of superior education and intelligence were eager to assist in munition factories for the period of the war. These men, however, could be efficiently employed only after some preliminary training in the use of tools, and it was with a view of making available labor of this type that the ministry of munitions, in cooperation with the board of education, arranged to use the resources of technical schools for the training of munition workers. As, however, the men in question could only be used during the period of the war and would afterwards return to their regular occupations, the aim of the ministry was to give only a slight knowledge of machine tools and wherever possible to confine the training to a particular operation. These men and also women were for the most part not engaged in actual production where they began their course. Hence every one of them is a new recruit to munition work and their employment involves no economic dislocation, such as inevitably results from the withdrawal of workers already engaged in other forms of production. Every hour taken from the woolen mills, for example, involves an economic loss; every unemployed architect trained as a munition worker is an economic gain.<sup>1</sup>

Careful records of working conditions are kept for each factory.

When the workshop or department has been started since the war, or the job is new to the establishment and the work is carried on under different conditions, e. g., with different classes of labor from those which customarily would have obtained before the war, a change in working conditions, for the purpose of records under the munitions of war acts, is considered to have taken place, and a record made. The record is expected to state clearly the existing conditions, e. g., the class of labor employed; that the job or department, etc., is new and that the establishment therefore had no previous practice.

The following are examples of cases in which records are required in regard to a change in the class of labor employed:

- (a) The employment of women on work formerly done by men or boys, whether skilled, semiskilled, or unskilled.
- (b) The employment of unskilled men on work formerly done by semiskilled men.
- (d) The employment of semiskilled men on work formerly done by skilled men.
- (e) The employment of men in one trade on work formerly done by another trade.
- (f) The employment of one class of tradesmen in a trade on the work of another class in the same trade, such as (1) riveters doing platers' or calkers' work, and (2) light platers doing sheet-iron workers' work.
- (g) Splitting a skilled man's job into two parts, one of which is done by a skilled man and the other by an unskilled man or woman.

The Training Section of the ministry of munitions has encouraged many technical and engineering schools to use their facilities for the training of munitions workers, and has given them cooperation and advice, as well as occasional money grants and varying amounts of supervision.

The Training Section itself trains workers in industrial factories, which it established and absolutely controls. It has encouraged the systematic establishment of instruction courses and training facilities in munitions works themselves. The classes in munitions work include:

Ordinary factory work.

Very heavy work, requiring strength and endurance.

Work which borders on engineering and puts the operator in the class of the skilled mechanic.

<sup>1</sup> Notes on the Employment of Women on Munitions of War, Ministry of Munitions. February, 1916.

## NOTE ON TRAINING.

The following note on training has been prepared by an official of the ministry of munitions, intelligence and record section, and is dated September 9, 1917:

Training for munition work in England is conducted, so far as the ministry is concerned, under three categories: Training in technical schools; training in instructional factories; training in instructional bays attached to particular works.

Technical schools are under the management of local authorities, financed and inspected by the ministry of munitions.

Instructional factories are under the direct control of the ministry and financed by it.

Instructional bays are under the management of individual firms, sometimes financially assisted by the ministry, sometimes not. In no case is help given unless the trained product is mobile and available for work anywhere in the United Kingdom.

The development of training has proceeded apace in proportion as the production engineers' gospel of manufacture on specialized repetition lines has gained general acceptance. Previous to the outbreak of the war his voice in England was that of one crying in the wilderness.

Owing to the development of the motor industry, considerable ground has been gained in the Midlands, notably in Birmingham, Coventry, Rugby, and to some extent in London, but with the exception of these districts, little headway had been made. Notably was this the case in small-arms factories and gauge-making establishments controlled by the war office.

The history of the training movement consists in the acceptance by the Training Section itself of the production idea as the basis of their operations; in education of the local education authorities along the same lines; in a similar process of evolution taking place on a large scale among works managers and manufacturers.

At first the section fumbled rather blindly, preaching a gospel it half believed to a limited number of somewhat skeptical adherents. At best it was a valuable recruiting agency, sadly hampered by lack of plant. It owes its technical salvation in the first instance to four men—Mr. Purdy and Mr. Buscard, representatives of leading American machine tool manufacturers, and Alfred Herbert and Oscar Harmer, of Coventry, men whose names are household words in the history of English machine tool manufacture.

These men were quick to see the possibilities of the movement, and ready to assist it. Attached is a minute of a conference that took place between the schools and the Training Section, which represents the first serious effort to get the movement on really scientific lines, and at which the basic principles were laid down by three of the gentlemen already named.

Since then progress has been continuous and vital. This is not to say that there have not been obstacles. Trade-union prejudices, due to a variety of causes (rate of wages, fear of post-war conditions) which it is unnecessary to enter into, have undoubtedly been a lion in the path.

Bad works management, in the hands of men to whom the production idea was totally unfamiliar, has been another more serious difficulty. Such officials have merely seen in it a convenient method for tinkering with wages, and have been blind to its real possibilities. Recalcitrant education authorities have caused obstructions and delays. But the production idea has gained acceptance, and progress has been and is continuous.

Attached is a note on the detailed work of some typical schools, written by J. L. Hall, in normal times assistant general manager of Messrs. Herbert's works at Coventry, whose services the Training Section has been fortunate enough to secure.

## INSTRUCTIONAL FACTORIES.

These have been built to further the ruling idea which underlies all training work, irrespective of what the objective of any particular factory may be. A scheduled list of some typical factories already existing, with a note on the particular objects of each type, written in each case by a specialist technical officer of the Training Section, follows:

## INSTRUCTIONAL BAYS IN FACTORIES AND INSTRUCTION IN WORKS.

*Instructional Bays in Factories.*—The erecting of new factories or large additions to existing ones, involving the installation of a large number of machines of the



same type for very special work, usually means a heavy and sudden demand for trained labor to run them.

Probably the largest manufacturers in this country to supply machines in quantities indicated above, are Messrs. Alfred Herbert (Ltd.), of Coventry, and this firm has placed at the disposal of the Training Section one of the bays of its testing department. After a preliminary training at one or another of the technical schools, batches of girls are drafted to this instructional bay, where they receive instruction (usually as toolsetters for capstan lathes) to fit them for the work of the particular factory to which Messrs. Herbert are supplying the machines and tools.

The advantages of this method of training are:

First, the girls receive their training on the actual machines and tools that are being supplied for the works, so that when they take up the work no new conditions arise which ordinarily operate against their self-confidence in the ability to do the work.

Second, it anticipates the labor demand as the labor can be trained while the plant is being installed. Messrs. Herbert act as the agents for the Training Section in making arrangements for the supply of this class of trained labor, and also guaranteeing its efficiency.

Third, the instructors, who are supplied by Messrs. Herbert, are specialists in this class of work, and one can therefore assume that the instruction is of the highest class.

Messrs. Hewlett & Blondeau, of Leagrave, is another firm that has placed a section of its works at the disposal of the Training Section for the instruction of girls in sundry branches of aircraft construction, such as woodwork, frame and wing building, plate metal fittings, erecting and viewing. The girls here are given a certain amount of instruction in a particular branch of work, and then transferred to the works of the company to work under ordinary production conditions. They are subsequently brought back to the training bay to finish off, before being sent out to any firm requiring such labor. The time spent by the girls under the firm's actual working conditions is found to be most valuable.

*Instruction in Factories.*—It often happens in a factory that production falls, or fails to rise under improved conditions, and it is not usually difficult to trace the particular department or departments at fault.

It is sometimes, however, a more intricate problem to diagnose where the disease lies in such departments, and the usually very much harassed works manager has not the time at his disposal to get at the root of the trouble in order to apply the necessary remedies. To this end the training section has the nucleus of a squad of highly skilled men (usually specialists in a particular branch of work) whose services are loaned to a firm in such difficulties as indicated above, and whose duties are to stimulate production by improving the methods of manufacture and giving instruction to the labor employed when such is of the nonskilled type.

The "Buckman" training school (London) is an interesting development of a modified form of factory instructional bay.

The school is housed in part of the warehouse premises of the large firm of importers of high class American machinery, Messrs. Buck & Hickman.

After outbreak of war, when all classes of manufacturers were being pressed to breaking point for production, a shortage of labor was at once felt. The class of labor brought into works as reinforcement was usually not highly skilled, and it was perceived by two of the resident American experts connected with the company (Messrs. Purdy and Buscard) that with this class of labor the productive capacity of the high class machines supplied by them was not being fully utilized in the national interest, and, further, that even this class of labor would become more scarce.

In view of this, these gentlemen obtained the sanction of Messrs. Buck & Hickman to put into running and working condition on their premises a number of such machines with the object of providing labor specially trained so that they would be thoroughly familiar with the working of these machines and have a good knowledge of their capacity for output.

The services of further expert mechanics connected with the company were obtained and a scheme of training put into practice.

The success attending their efforts is a tribute to their sound conception of the necessities of the labor situation and the energy with which the work of training was taken up by them.

Since that time further plant has been added, and the establishment run under the auspices of the Training Section as a general center. Further extensions for training labor for tool-room requirements are now in progress.

It will be readily concluded from the foregoing note that training has been most successful where manufacturing operations can be standardized and repetition processes widely introduced.

It therefore follows that it does not present the same scope in branches of engineering which do not really lend themselves to these methods.

Heavy marine engineering, where repetition work is infrequent, is an outstanding example of this.

Above all, extravagant claims must be avoided and a clear understanding arrived at of what intensive training can do, and of what it emphatically can not do. Under no circumstances must the epithet "skilled" be applied to the trained product. It is a total misnomer. The student in any case must be of good general education and physique, and a reasonable standard of health must be rigidly insisted on. As the majority of students will be nonindustrials, they must be sympathetically looked after.

It must not be forgotten that the transition period of acclimatization to the life of manual work is an arduous period, especially in the case of a young woman.

Adequate welfare arrangements, and what is even more important, good will and a warm welcome from the skilled men, are essential, if a full measure of success is to be secured.

Some 35,000 pupils have now passed through the section and have been placed in controlled establishments all over the United Kingdom. Its operations are broadening in scope every week, and now command a considerable measure of confidence among works managers and employers. It is not yet filling the rôle assigned to it by the responsible minister, but it has moved a considerable distance in the direction indicated.

#### TRAINING SEMISKILLED MUNITION WORKERS IN TECHNICAL SCHOOLS.

The ministry of munitions, acting in cooperation with the board of education, the Scotch education department, and the board of trade labor exchanges, developed the following scheme for training men and women in the technical schools to enable them to take their places as semiskilled workers in munition factories:

The scheme for training semiskilled workers in technical schools is fundamentally sound. When conducted on proper lines, training is valuable for the factories, wherefore the ministry has decided to encourage the use of facilities for training in all technical schools to the full.

The ministry desires that preference should be given to the training of munition workers. \* \* \* Where lathes are available in technical schools they would be better employed in training workers for munition factories than in the production of a small number of shells.

No rigid set of regulations should be laid down \* \* \* but there should be certain general principles observed throughout in such features as the selection of learners, the organization of the tuition, the arrangements for dealing with the output, etc.

It is important and essential that the training be thoroughly practical, and purely educational ideals must give place to utilitarian methods.

Benchwork should be reduced to a minimum. Impart "machine sense." It is desirable that principals of technical schools and their instructors should get personally into touch with munitions works and get acquainted with their methods \* \* \* so as to direct the tuition on the most suitable lines.

Arrangement was made with the treasury to pay expenses to local education authorities providing such training classes to meet the requirements of the ministry.

Where no training scheme existed, a small local training committee was formed to assist the local education authority and the managers of the school or schools concerned. This normally included one or more representatives of the authority, the principal of the technical school, the secretary of the local munitions committee and the manager of the labor exchanges. Where there was no munitions committee, the aid of the labor officer of the ministry of munitions was sought.

The ministry does not insist on absolute uniformity, but suggests the following outline as a plan of supervision:

1. No male learner must be accepted who is of military age unless he is for some reason debarred from military service.

2. As far as possible learners should be men or women of superior intelligence who are likely to learn quickly, e. g., professional men, those who have had a secondary education, men skilled in other trades, such as cabinet-makers, jewelers, etc., who will return to their ordinary occupations after the war.

3. Preference should be given in the first instance to those who are willing to leave the town where they live and go where there is demand for labor.

4. Each learner entering a class must give a written undertaking that he will work whole time in a munition factory on the completion of his course. If he fails to do this without good cause, the cost of the training will be recoverable.

5. No fee should be charged for any course in respect of which it is intended to claim a grant from the ministry of munitions.

6. Each learner satisfying the head of the school should, on the completion of his course, receive a certificate of efficiency specifying the nature and duration of the course. The utmost care should be exercised in this matter. The whole scheme will fail if incompetent persons are placed in factories on the strength of their certificates.

7. The head of the school must have absolute power, on the advice of his instructors, to eliminate the unfit at any stage of the training. This power must be fully used if waste of time and money is to be avoided.

8. Weekly returns must be made in duplicate to the ministry of munitions for their use and that of the board of education (or the Scotch education department).

9. Periodical inspection of training classes will be undertaken by the board of education inspectors and representatives of the ministry of munitions.

10. It will probably be found that the number of applicants will be far in excess of the accommodation available and that a waiting list will be necessary. It is not essential that learners should be taken strictly in the order of their application. Priority should be given to applicants who seem likely to make specially good munition workers.

11. The length of the course must be largely conditioned by consideration of local circumstances. The ministry is not prepared to sanction any course which provides less than 30 or more than 100 hours of instruction. It is suggested, too, that in all cases where classes are worked in shifts, arrangements should be made that no course should last for more than one month.

The financial arrangements made between the ministry of munitions, the board of education, the Scotch education department, and the treasury allow for the payment by the minister of: Salaries and fees of teachers or a proportion of these, according to the time devoted to the work; actual cost of fuel, light, cleaning, and materials so far as not supplied by the ministry of munitions; cost of making good any damage to premises, equipment, or apparatus; a reasonable allowance for depreciation of apparatus; the cost of altering, providing, or re-assembling machinery to meet the special requirements of the ministry of munitions.

All such claims must be transmitted to the board of education or Scotch education department, who verify them before recommending them for payment by the ministry of munitions.

Members of training committees were urged to leave nothing undone to insure placing these students in munition factories. The labor officers of the ministry were instructed to place at the disposal of the training committees any information they may be able to obtain as to the attitude of employers or prospective vacancies.



### The ministry's suggestions continue:

Normally the output of the technical schools will be absorbed in local factories. But cases will inevitably occur where local openings may not be immediately available. For that reason it was suggested that preference be given to those applicants who are ready to work anywhere. In such circumstances, the machinery of the labor exchanges should be of great assistance.

Where there are technical schools in nonindustrial centers with adequate equipment for training, it will probably be found that there will be a considerable number of applicants willing to work elsewhere after training. In this case the transference of the labor can be effected through the labor exchange. If it is found that an adequate supply of such applicants is not forthcoming, the ministry of munitions and the board of education would favor the temporary removal of machinery to some training center where there is a demand for labor and facilities for placing workers.

With regard to the placing in employment of learners trained in technical schools, though there must inevitably occur cases in which there will be delay, it is anticipated that close cooperation between members of the training committee will reduce such cases to a minimum. In this matter the ministry does not wish to insist on any hard and fast system, for arrangements have been made in certain centers for bringing the technical schools and employers into contact, with most gratifying results. It is not proposed to disturb these existing arrangements where they are working satisfactorily.

The ministry of munitions has approached the central office of the board of trade labor exchanges in this matter, and an arrangement has been made which has been already communicated to the officers.

Briefly, the scheme is to the effect that the labor exchange should be supplied by the school with the names and particulars of all pupils at the end of their course, and that it should also be in touch with a sufficient number of employers who are willing to engage the pupils. The particulars with regard to the trained pupils will be kept in a special register at the labor exchange.

Close cooperation between the education authorities and the labor exchanges is most important, because they are in a position to give valuable advice as to reducing or increasing the effort of the schools in correspondence with the probable demand for labor in the locality or elsewhere.

It is to be understood that all these proposals apply to the training of women as well as men, but the ministry is not in a position to decide definitely in what proportion women should be accepted as learners in particular centers. This is a matter which must be left to the discretion of the local training committees, who should have at their disposal abundant evidence as to the demand for women workers and the possibilities of securing employment for them. The ministry would emphasize the necessity of getting assurances of employment for women before undertaking to train them.

The evidence collected by the ministry of munitions on the work of the training classes has proved clearly that there is a very large number of men and women of superior intelligence who are anxious to help in the production of munitions and who can be absorbed into munition work through the technical schools with the smallest possible dislocation of labor conditions both during and after the war. With the prospect of an enormous increase in the demand for munition workers it is felt that no source of supply must be neglected. These "trained" workers will not be skilled engineers; at most they will be semiskilled workers, but having had on an average 60 or 70 hours' practice on lathes or the like they should be more useful recruits in a shell factory than those who have never seen a lathe before. The ministry is convinced that the scheme will help in some degree to provide the labor which will be urgently required, and that it needs only a careful attention to local conditions and the cordial cooperation of the various authorities to make it a success.

H. LLEWELLYN SMITH.

Some of the training schools have won national fame.

In Liverpool's great technical school, which cost upward of half a million dollars, the conditions are most interesting. There are 1,500 pupils in the evening classes, but except for some special summer classes of adults, this finely constructed and well-equipped building is unoccupied during the daytime, largely, perhaps, because it is feared that daytime industrial instruction would interfere with the regular public

schools by prematurely attracting pupils from them. As a rule, pupils do not apply for instruction in this school unless they are working, or have worked, in the trade that they wish to study.

The famous Manchester School of Technology is housed in a magnificent building, which cost \$1,500,000, and is run on a correspondingly large scale. The enormous running expenses are paid in part by the State, in part by the city, and in part by students' fees.

London seems to be fairly well provided with polytechnic schools of the class of those in Manchester and Liverpool, for it has seven such institutions, to which boys of 16 to 18 years of age are admitted after a shortened course in the secondary schools. Its provisions for elementary technical education assume enormous proportions.

### TRAINING UNSKILLED WORKERS.

In the new munition works of the British Government throughout the land classes for munition workers were started.<sup>1</sup>

In November, 1915, 130 students were in the Birmingham School and 880 were awaiting admission. The course lasts six weeks and 286 passed through. The time required is four hours a day, five days a week.

"The men can be instructed in a marvelously short time, if they are adults, willing to learn and anxious to get on, and provided they are handled by skilled teachers who are also highly trained mechanics," was the general verdict on the training plan.

The following British description<sup>2</sup> of the founding of factories illustrates the Government's method:

Before the war Messrs. Blank & Co. were a well known firm of engineers; they had established a sound reputation for good workmanship and had shown that they knew how to organize and conduct an engineering factory.

The Government said to Messrs. Blank:

"Choose a suitable piece of land. We will buy or hire it from the owner. Erect on it a suitable building. We will pay the cost involved in buying and erecting the necessary material, and will give you, as it were, an architect's fee for designing the works and looking after the building operations.

"Collect a staff of work people and train them. When all is working, we will provide you with money to pay the work people's wages, and will pay you to act as our managers in the new works."

This is the way in which the Government orders were carried out by Messrs. Blank:

"Instead of designing and making a lathe capable of performing the fourteen or so operations required on a shell, they constructed fourteen different types of machines, each of which was specialized to do a single one of the operations and no more. The simplification of the mechanism in each case was carried to a remarkable degree and as a result, girls and others with no previous acquaintance with the inside of an engineering factory could be taught to use the machines efficiently in anything from a fortnight to a month."

<sup>1</sup>The Engineer, November 5, 1915; p. 435.

<sup>2</sup>Ibid., July 2, 1916; p. 47, vol. 122.

The courses at the training center are so arranged as to allow the newcomer to undertake at first the simplest operations on the machines; after attaining a certain proficiency the learner will be instructed in more advanced processes.

An approved student who "makes good" in elementary work is passed on at once to more skilled operations.

Having learned to read the micrometer, the little instrument by which the finest of measurements are calculated, she can then proceed to the courses on machinery producing such munitions as aero-engine parts, screws, bolts, gun parts, fuses, gaines, or other courses.

Alternative courses are held at certain centers for mechanical drawing and draftmanship; oxy-acetylene welding, electric welding, and wood work for aeroplane construction.<sup>1</sup>

A part of the training has been done in the factories themselves, but in the smaller plants not employing a sufficient number of people to warrant a training room the Government was obliged to pool interests and supply workers trained in schools attached to the various technical colleges, and in plants taken over by the Government and used for training purposes. The training referred to is not general, but is confined to a particular type of machine.

The following is a description of actual operations performed in shell making by women after training:

The rough piece of bar is first rough-turned, the end faced off, and then passed on to the next series of machines, where it is finally turned. The body is then chucked at the opposite end and the rough part, held in the chuck as in the previous operations, beveled off roughly to the shape of the nose. For the next operation the shell is transferred to a capstan lathe, where it is first rough-drilled, the bottom shaped out, and the ends fashioned off; two tools in the next series of capstan lathes complete the boring operation. The hole in the nose is then opened out, undercut, screw cut, the outside end beveled, and the taper for the fuse formed. In this operation it was originally intended that the screwing should only be done roughly in the machine and finished afterwards by a tap; but the girls took upon themselves the final screw-cutting on the machine to gauge, and this has been found absolutely satisfactory. Then come the operations of profiling the nose to the final shape, cutting off to weight—including the weighing—and boring out the base, which need no description.

The next two operations are of a more delicate nature—the boring to size and undercutting and the screwing of the base. For the first a special milling attachment is used. It consists of a revolving milling cutter with an undercutting projection on the end, which is mounted eccentrically to and revolves in a contrary direction to the shell. For the second a small revolving chasing tool is used mounted in the same manner, which is found to give much better results than a tap screwed into the blind hole. The groove on the outside of the shell for the gas band is then turned and undercut, and has the waves formed on it to prevent the band from turning; this requires two tools. After this the band is pressed on, turned down, and then profiled to take the end of the case.

Next comes the one operation performed by men, the screwing in of the base plug, which is a steel stamping. This is screwed down very hard onto marking and taken out to see that the surfaces are in actual contact. The girls perform the operation of rolling the edges of the plyt to set it fast, and this is an operation requiring a considerable amount of exertion. Then the square on the end of the plug is cut off, the end of the base plug faced off flush, and the grub-screw hole drilled and tapped in the nose. For this a three-spindle drill is used, the first drilling the hole, the second countersinking, and the third tapping, the hole being drilled while the tap is withdrawing itself from a tapped hole.

The machine used in the next operation, stamping on the body the parts of the shell, is worthy of note. It consists of a traveling horizontal die plate placed at a definite distance below an adjustable plate, the shell being rolled between the two

<sup>1</sup>From Women and Munitions of War.



and the impression being very readily learned and controlled by girls. It impresses in both directions of movement, those able to make the necessary marks and title on the shell body at the rate of fully 300 in one hour.

A very noticeable feature was that the girls all seemed so happy and contented. They will not admit that the work is too heavy for them, and to see them handling 4.5-inch shell bodies on the large combination lathes without using mechanical assistance or the laborers provided by the firms is a pleasure.

Their health appears to be good; they are gaining in muscle and skill every week, and the quality of the work they turn out is all that can be desired. So far has the output on some of the operations exceeded expectation, owing to the keenness of the girls, that some of the machines provided have actually been found to be superfluous, and, indeed, the machines have been shown to be capable of more work than had ever been believed to be possible. We think, therefore, that we are fully justified in claiming that by the increased use of women for all machining operations on parts up to a reasonable size the problem of the shortage of labor will be solved. There is plenty of such labor available in the country, and all the women are moved by the keenest spirit of patriotism.<sup>1</sup>

If a manufacturer fails to introduce women for dilution according to the standard set by the ministry, he is visited by a dilution officer who informs him of the Government's requirements and of the practice of other establishments. Should the plant owner be unwilling to comply with the standards set, the ministry is able to enforce compliance, for, through the labor exchanges, it can cut off the supply of additional workers to the plant; second, it can draft skilled workers from the plant to other plants; lastly, if the manufacturer still refuses to introduce women, the Government has power under the defense of the realm act to take over the plant and operate it itself.

The possession of these powers and the knowledge on the part of employers that the Government can use them, makes their exercise generally unnecessary.

As regards special trade training,<sup>2</sup> arrangements have been made in some instances for women from the relief workrooms to attend London County Council evening classes in their own trade with a view to improving their industrial skill during the period of their unemployment. A notable instance of this is afforded in the St. Pancras workroom, where a number of women have entered for dressmaking or other trade classes, at the London County Council Trade School, in Queen's Square, Bloomsbury. The women are allowed time off from the workroom and receive maintenance for attendance at the classes.

William Hard, in the Metropolitan Magazine, thus writes of training results:

The trade-unions of Great Britain stepped up to the altar of war and placed on it all their hard-won rules and rights and privileges, all their restrictions on output and employment. What was the consequence? Immediately in thousands of factories all over Great Britain there was a revolution in methods of production. Instead of old awkward machines, operated exclusively by union members, by skilled craftsmen, there came to be long rows of new, improved machines, operated not merely by skilled craftsmen, but by men semiskilled and by women.<sup>3</sup>

Winston Churchill, minister of war munitions, says that 2,500,000 men and women are now (1918) engaged in war production and working directly under the direction of the ministry of munitions.

<sup>1</sup>Engineer, London, September 3, 1915, p. 218, vol. 119.

<sup>2</sup>Bulletin of the Central Committee on Women's Employment, March, 1915.

<sup>3</sup>See pamphlet, The Importance of the Human Factor in Industrial Preparedness, dated May 22, 1917, p. 7.

*Schedule of time required for intensive training of munition workers.*

Probationary bench work, one-half to one week.

Driller:		
(a)	Pillar drill (upright).....	1 week.
(b)	Radial drill.....	2 weeks.
Miller:		
(a)	Universal milling machine.....	2 weeks.
(b)	Vertical milling machine.....	2 weeks.
Shaper:		
(a)	Shaping machine.....	2 weeks.
(b)	Shaping machine, American type.....	2 weeks.
Slotting machine:		
(a)	Large and small.....	2 weeks.
Turret (Herbert) No. 4.....		2 to 3 weeks.
(a)	Tilted turret.....	1 week.
(b)	Capstan lathe.....	1 week.
Tool setter.....		Until placed.
Turner:		
(a)	Eight-inch and 9-inch center lathe.....	4 weeks.
(b)	Seven-inch center lathe.....	4 weeks.
(c)	Five-inch center lathe with chuck.....	1½ weeks.
(d)	Five-inch center lathe without chuck.....	1½ weeks.
(e)	Special work (assistant).....	Until placed.
Toolmaker:		
	Forge bench and lumber, No. 2 grinder.....	6 weeks.
Filter:		
(a)	Precision bench work.....	10 weeks.
(b)	Small drill.....	1½ weeks.
Gauge maker:		
(a)	Drill and bench.....	8 weeks.
(b)	Small grinder.....	3 weeks.
Grinder:		
(a)	Universal grinder.....	4 weeks.
(b)	Small grinder.....	2 weeks.

**TRAINING TEACHERS.**

Since it is industrial training that is wanted, the essential things are the industrial atmosphere, methods, and standards of efficiency.

Any mechanic of a degree of intelligence to become a candidate for a trainer's position will be trained sufficiently in methods of instruction to make him the better type of shop teacher.

Shop instructors are generally recruited from the ranks of journeymen; some of them have only a common-school education and none of them are college men.

Strong points of the mechanical teachers are the following:

He can do good work himself, has confidence in demonstration, and therefore imparts confidence.

He can apply commercial standards, owing to his practical knowledge. He can create a shop atmosphere.

He is in sympathy with the labor element of society.

He can give the student correct guidance as to desirability, opportunity, and dangers of the trade in question; in other words, he is a better authority, having followed it, than the trained pedagogue who has read about it.<sup>1</sup>

<sup>1</sup> Mechanical World, vol. 58, July-December 1915, p. 213.

The following material on training instructors is taken from an address by Mr. H. Kerr Thomas, assistant to the president of the Pierce-Arrow Motor Co., before the general foremen, June 17, 1918:

I have recently been seeing a good deal of the executive heads of the Rolls-Royce Co. As you know, before the war they manufactured a very high grade car in small numbers. The Rolls-Royce is the same sort of car in England that the Pierce-Arrow is in this country. It is a very large and expensive car, and sold in a very limited market. Now when the war came about some four years ago, that particular company, in common with many others, in fact, every other concern in England, was faced with the necessity of cutting off its production on 24 hours' notice and coming to a dead stop by order of the Government. They were only in the same "boat" with everybody else. In other words, the Government determined they weren't to build any more expensive cars, but they were to build something which it needed. The immediate necessity at that time was, and still is, the aircraft engine. I asked them the other day how they got on for labor. "Oh, we are doing fine now," they said.

At the beginning of the war they employed 3,000 men. Within the first few weeks of the war, in 1914, 2,000 had gone into the army, leaving 1,000 men, men who were outside the draft age and who were technically very highly valuable, too valuable to go into the army. To-day they have about 8,000 people working for them building only the one thing, the Rolls-Royce aircraft engine, which is in the very front rank of aircraft engines today. It is not an easy engine to build, because no aircraft engine is. The Rolls-Royce Co. is building them with one-third of their factory women, another third partially disabled soldiers, and the remaining third old gentlemen—retired merchants, bankers, lawyers, and people who couldn't do anything in the war and the Government put them to work on machine tools. It doesn't sound a very attractive proposition, but they are turning out engines to-day of the highest quality, and are producing them at an enormous rate.

The one-third who were left over, who didn't go into the war, the technical staff, engineers, and the workmen who were allowed to remain, have been made into foremen, setters-up, charge hands, and that kind of thing.

In the first place, it goes without saying, if you have a highly skilled worker working for you, you hire him, you give him a job to do, he says he can do it, he goes ahead and does it. If you do not have the highly skilled man, you have first of all to tell him to do the thing, then stand over him and watch him to see that he does it, both of which things you never had to do—or only to a limited extent—before. Then, owing to the lack of experience on the part of the workers, with the best intentions they will bring to you all day long problems which they never brought before, which they themselves unconsciously solved. You must make very hasty decisions as these questions come up. You can not say, "I will go and see," "I will ask so and so," "I will see tomorrow," or the like. You have got to decide right there: "We must do this" or "We must do that."

The next thing which you have to develop, which we all have to develop, is a very much greater resourcefulness, because the poorer help necessarily makes more mistakes, and one has got to be all the time devising means for preventing mistakes if possible, and for rectifying them where they have happened, because one can not be everlastingly scrapping them and putting them away, saying, "That thing's gone," etc.

Those three things—the closer supervision, the more rapid decision, and the greater resourcefulness—combined naturally make everyone of us able to take more responsibilities than we did before, and the determination to make good with inefficient help is the quickest way to improve the quality of the help, because all of the time they are growing into something which is much better.

At the present time you are all rather like a man who has lost a leg. There is not the slightest use in telling him he can grow another one, because he can't, but we will give him an artificial leg, and with a little trouble he will be able to work it, and after a little while, he will find he will be able to walk as well as he could before. We have this condition right down the line.

The first thing we are going to establish is a training school—I call it that for want of any better word, but I mean this—a department (I do not know just where it will be placed) where the new help can be taught, because it has got to be taught. One can not put absolutely green people, not accustomed to thinking in terms of machinery or even of hardware, before something to be done and tell them to do it.



To start with, whether it is men or women, to be suddenly faced with a machine which is making all kinds of unpleasant noises, slipping things about, and splashing around, they have got to be taught that if they keep their fingers away the machine will not hurt them. They have got to be taught that the machine will set the pace and they have got to learn to follow it in such a way that it isn't kept waiting.

This is not an easy thing to do, and it takes a lot of patience. I want each of you, if you will, to look at every man in your department, under your particular charge, and see if you can do without that man. I do not want you to fire the man, that is another story, but I want you to pick out the best man in your department and decide what would happen if that man died tomorrow. You can not go out and get an equally good man to replace him, yet you have got to keep on grinding out the particular thing on which he is engaged; and I want you to go on right down the line, and decide what is necessary to train the men who do each operation that happens to come under your particular charge, and when you have thought that out (it will take a little time to do it), and digested it very carefully, we will try to arrange the best method of teaching the help. I am not going to disguise the fact that the most of the help we are going to get are women. There aren't any more men. The few men there are are required in the army, and those who are not will be required to grow corn and wheat.

Now then, you have got to constitute yourselves schoolmasters, and decide first what you want to teach your people and then how to go about it. We shall establish an instruction department, where you can say to the instructors, I want five, ten, twenty, thirty, or whatever it may be, operatives who can do so and so, and I want them taught to be able to do this or to be able to do that, because it is no use for the instructors to use their own ideas of what your men want. Now, they are going to take raw material, turn it out to you in a half-baked condition, and you have to finish the cooking, and you have got to decide for yourselves what the preliminary process of cooking has to be. You must study every man in your particular department with a view to seeing what his special abilities are which will enable you to use him; and these are the things which must be done with all of the green help we are to get, and you must judge in just what channels we can best give instruction.

Above all, please remember what I said. I am not making complaints of anybody. I know what you are up against. I want you to realize that from now on we have got to make an entirely fresh start with our method of running the factory. In all probability we shall have to increase the size of the factory very materially in the near future. We have got to purchase more machinery, and that means, of course, more machinists or apologies for machinists, and I want to keep the help just ahead of the machines if I can. In other words, if we ordered a lathe or a grinding machine to-day, the probability is we shouldn't receive it for three or four months, but by the time it comes here, we must have someone ready to work it. You can't wait until the machine gets here, then say you want a man for it, because he isn't there. We have got to get him here first and make him.

## PROBLEMS OF TRAINING AFFECTING WOMEN.

Lack of accommodation for women in factories was the earliest practical objection to their introduction in British industry. It was a useful argument for manufacturers who wished to avoid dilution, until the authorities became exasperated with its constant repetition and refused any longer to accept it. It was realized that in many small plants not enough women could be employed to warrant the expense of providing accommodations for them, or not enough space could be obtained; but lack of accommodation in general soon disappeared as an excuse for not employing women.

### HEAVY WORK.

The war has demonstrated that brute force does not pay, whether on the battle field or in the workshop. But it was not until the second year of the war that machinery was generally substituted for man power in lifting heavy weights, and the contrary practice was recognized as uneconomical of energy.

Moving and adjusting parts of some machines calls for considerable exertion, but this does not hold true generally of large modern machines.

The war proved the futility of hiring skilled men to do minor jobs that could as well be done by machine power, and the substitution of long-armed star wheels for small hand wheels, and other simple devices, have made possible the employment of women where formerly strong men were needed. In many factories women might have been even more extensively employed had small-job cranes with differential blocks been put into use. However, there are many jobs where the expenditure of energy is too continuous and too great for women.<sup>1</sup>

The following memorandum describes conditions in the national projectile factory:

A word may be said in conclusion regarding the staffing of the forge departments. At present no female labor is employed in the forge itself, nor is it probable that it will be in the future, at least in the forge proper. The heat here is somewhat trying and it is believed that male labor alone is suitable. Untrained men were actually employed to begin with. On the average 14 days' instruction is found sufficient.

The tool room is staffed by both men and women. The portions of the presses actually coming into contact with the hot billets require very frequent renewal, so in the case of the punches and their components, \* \* \* and the greater part of this work is carried on by women. Renewal of parts of the valves and other delicate adjuncts of the presses remains in the hands of skilled male workers who are also responsible for the management of the shop and the instruction of the women.

#### OPTICAL MUNITIONS WORK.

In the field of optical munitions the war has opened up a branch of skilled handicrafts to women in which they are already doing excellent work. Moreover there seems every prospect that it is work in which, when the war is at an end, there will be good and increasing openings, for, since Britain in prewar times depended to a large extent on enemy countries for optical work this is now one of the captured trades in which there is likely to be a considerable demand for workers for some time to come.

A visit to the optical munitions training school at the Northampton Polytechnic Institute, 280 St. John Street, E. C. 1, is convincing as to the special qualifications which intelligent women possess for this work, demanding as it does delicacy of touch, concentration, and the utmost care and accuracy. The school is under the direction of the ministry of munitions, its special object being to train women for optical munition work, with a view to their entering certain factories to which they have been allocated by the ministry. The course consists of a training at the school, occupying from six to twenty weeks (six weeks being the minimum term), the worker completing her training after she enters the factory to which she has been passed on.

The branches of optical work which the students may learn during the course at the Institute are: Roughing lenses and slitting; smoothing and / or polishing lenses on automatic machines; the same processes on treadle machines; smoothing and polishing steeply curved surfaces or "singles"; centering, edging, and cementing lenses; splitting and roughing prisms, or angling prisms; smoothing and polishing and / or finishing.

<sup>1</sup> Dilution of Labour Bulletin, Ministry of Munitions, vols. 2 to 7, April, 1918.

The training may be general or specialized, the latter being arranged for, if students are allocated to a manufacturer who has definitely stated that he requires a worker for some particular process. Work that recently has been done by girls and women in the school includes objectives of various types up to 2 inches in diameter, chromatic and 4-lens eyepieces and binoculars, and periscope prisms. Although these technicalities are more or less Greek to the uninitiated, this enumeration is sufficient to show that the work is such as to be embarked upon only by the really keen, intelligent, and reliable; and when, further, it is realized that accuracy to the millionth part of an inch is required for very high class optical work some idea can be formed of the care that is necessary to obtain any great degree of skill. At the same time the interest of the work will be compensation in itself to a really earnest student, who is alive to the possibilities that lie before her. Good health is, of course, an essential, as, although no great physical exertion is involved such as lifting weights or controlling heavy machinery, the work entails, as a rule, a great deal of standing.

While training, the students work 36 hours a week, starting at 9:30 each morning, and during this period they receive a weekly allowance of 10s. The amount of the wages to be received hereafter will, of course, depend on the individual ability, the length of training, and the standard of work produced. A definite scale has been fixed for workers who have trained at the school for less than 12 weeks, these, while finishing their training at a factory, receiving a weekly wage of 15s. from the seventh to the twelfth week, 17s. 6d. from the thirteenth to the eighteenth, and 20s. from the nineteenth to the twenty-fourth. After that 25s. a week is the sum fixed, but this can easily be increased to 30s. or more by workers who have become competent; while those who acquire sufficient skill and are willing to go to Scotland after twenty weeks' training start at a salary of 35s. a week.

As soon as women are skilled enough to handle work usually done by men, it is probable that the wages will be raised in proportion to the advance in proficiency; and it is considered that women engaged on optical work of a kind generally done by men should be earning not less than 7d. per hour after six months' experience, and in many cases a larger amount.

Before enrolling, every worker must be approved by the ministry and is required to sign an agreement to serve until three months after the signing of peace. All communications in connection with this training scheme should be addressed to the Optical Munitions Training School. The work is undoubtedly one of national importance quite sufficient to satisfy the patriotic aspirations of the woman anxious to do her part in the winning of the war; but if she has also to look to the question of earning in days to come, in entering upon this training she is equipping herself for what may prove a useful employment in the future in the field of general optical work.

#### ELECTRICAL WORK.

On the first engagement of women in electrical work they were put to the machines in the shops, to general work (including armature work) in the electrical fitting shop, and to cleaning up and repairing a variety of electrical appliances. They worked under the instruction of



skilled men, and from the onset their progress was encouraging. In July of 1917 the chief draftsman began a series of popular lectures to women on elementary matters affecting their work. One lecture was on materials; another on the cutting tools of machines, including drills; another on hand tools for metals; another on rules, micrometers, calipers, gauges, and screws. The next series dealt with electrical theory. In one lecture an elementary explanation was given of force, work power and electrical energy; in another, the elementary notions of pressure, current and resistance; in a third, the laws of resistance; and others dealt respectively with the electrical circuit and its practical units, electrical power, and the effects of current in a circuit. One lecture then dealt with magnetism and its application to electromagnets; another with the general phenomena and construction of dynamos, and others with the construction and winding of coils and the construction of rheostats. Two lectures dealt with the principles of telephones and their application to various marine types; and the course was concluded by three lectures on electric lighting, dealing respectively with the electric lighting of ships and of shore establishments, and the construction, use, and abuse of electric cables and wires. Two supplementary lectures were given on special types of appliances. The lecturer was of opinion that some of the women did not look favorably on the course, and it is possible that it covered more than some of the hearers could reasonably be expected to assimilate. At the same time, no doubt is felt that the general efficiency of the women is due in part to what was taught them in this way, and, indeed, a considerable and perhaps a sufficient effect may be produced on the practice of shop when knowledge such as was conveyed by these lectures is distributed among the workers, who may be left to influence each other as far as is practically important, with much that they did not pick up individually in the class.

To whatever cause, however, the result may have been due, the progress made by women has been both wide and rapid. Their work in the shops at the present time includes lathe and machine work, engraving, and lacquering; armature and coil winding; making firing circuits, portable electric-light fittings, etc.; repairing and testing motors and secondary batteries, including cleaning and reacidifying; repairing, calibrating, and testing electric meters; joinery; coppersmiths' work and zinc lining. They also clean, repair, and test range-finders, and do the whole of the work on bell, hummer, and various types of telephone circuits, working in the proportion of about five women to one electrical fitter as instructor. On the general establishment light and power system they take part in the care and maintenance of the machines, including motor generators and yard lighting, meter reading, the switch-board at the generating station, etc. A large number of them, by their own choice, are working on piecework.

In the autumn of 1917 it was decided to introduce women on board ship to rewire electric light and power circuits, to do repairs or general installations, etc., work that was originally done by electrical fitters and latterly by up-graded skilled laborers. Those who were intended to work on board ship were placed in gangs of about 20 women under two capable electrical fitters from the men in the department, and given a room in which parts of imitation bulkheads were fitted up, and the actual cables, lamps, switches, section and distribution boxes, etc., as

used on board ship, were put into their hands. In that room they were taught to put up short but complete ship-wiring installation, including almost every particular process originally done by electrical fitters. From four to six weeks is found sufficient to fit them to be taken on board, and about another week, for those who had not worked on ship-board before, was required to give them sufficient local knowledge of ships to be able to master the relative positions of the various decks, compartments, etc. As a rule each gang was accompanied by the fitters who had taught them, and by a chargewoman whose chief duty was to see that they kept steadily to their work.

The work on board ship includes rewiring electric light and power circuits, repairing general installation, etc., and was originally done by men. A number of women are working, by their own wish, on piece-work, and some have earned up to 90 per cent excess of their time rate. They work always in couples. The proportions in which women of various grades are put on to ship work are roughly 65 per cent fully trained and carrying out the work in all its branches; 15 per cent being trained preparatory to being drafted on board; and 20 per cent being entered for training. The whole of the staff of women is under the general charge of two inspectresses, one for those on ship board and one for the land shops and yard. These have no technical functions as electricians, but supervise the moral, physical, and general welfare of the women during working hours, and support the charge hands in keeping the work steadily going.

#### AEROPLANE WORK.

A London firm which before the war was engaged in motor coach and body building went into the manufacture of complete aeroplanes. In this factory 41.2 per cent of the working force of 344 are women, all trained on the premises. The women begin by making in large quantities small wood parts, such as small supports, packing blocks, diagonal stiffeners, and so on, and in cleaning up. Later on they go into the rib shop, where they make all ribs, including riblets for Stopwith 1½-inch strutter, compression ribs, and box ribs. It is stated that the scrap made on this work is only ¼ to ½ per cent. Later women learn assembling, working in gangs of seven under a foreman.

This firm tried setting a woman to work as helper to a man, on assembling main planes, but found that the women did not appear to learn much and both workers wasted too much time. Women are now trained in a separate small shop.<sup>1</sup>

#### TRAINING TO MAKE ELECTRIC LAMP BULBS.

An Edinburgh firm has recently started training women in blowing electric lamp bulbs. These women have now had three or four months' experience, and the firm reports favorably on the progress made. Some of them have turned out as many as 400 good bulbs per day. The process consists in "gathering" a sufficient quantity of glass from the pot of molten glass in the furnace; "marvering," or rolling the glass into cylindrical form; blowing the glass out partly, and allowing the bulb to lengthen by the action of gravity; completing the operation in a mold of the proper shape. The opening and shutting of the mold is operated by the blower's feet.

<sup>1</sup>Dilution of Labour Bulletin, November, 1917.

On account of the heat of the furnace in which the glass is made, and the necessary exposure to a very high temperature during gathering, the process has not hitherto been considered suitable for women. Screens, however, have been erected to prevent too much heat radiating to the workers.<sup>1</sup>

#### WORK ON PISTON RINGS.

In a firm in the York and East Midlands division making piston rings for aero engines and standard ships, the women do all the milling; three of them with two men do the turning, and ten with three men do the grinding.

The use of magnetic chucks has been found particularly advantageous in reducing the women's muscular exertion. The work is done to limits of 0.0002 and 0.0003 inch. Two women act as charge hands.

#### WOMEN MAKE TOOLS AND GAUGES.

In a bolt and nut works, 1,400 women not only make the factory's product but also all the tools and gauges required. One hundred and eighty women work in the tool room, all having been trained on the place. Thread milling cutters used, except for hardening and sand blasting, are made in seven operations by women. Reamers, requiring five operations, are made by women, except hardening and sand-blasting. No women were employed before the war.<sup>2</sup>

At works in the London and S. E. Division the women's tasks include milling, drilling, grinding, soldering on electrical shell and fuse work, and viewing. In addition to their employment of women, these works pay particular attention to the employment of discharged soldiers and boys, who are kept almost entirely in shops separable from those in which the women are employed.<sup>3</sup>

The ministry of munitions has set the seal of its approval on the training given at the school for women welders at Notting Hill Gate (originally organized by Women's Service, 58 Victoria Street, S. W. 1) by taking over all expenses and payments connected with it. The conduct of the school and the choice and placing of pupils are carried on as before, the ministry having decided not to interfere in any of these matters. The school was taken over as a result of an inspection on behalf of the ministry, when both the work of the pupils (all educated women) and the economical management of the school were most satisfactorily reported upon. As the ministry desired that the training should be free, and the Women's Service could not afford to carry it on upon these lines, the ministry undertook all charges, on condition that 20 pupils should be constantly in training. The ministry made many additions to the plant and equipment of the school, where about 200 skilled welders have already been trained. When trained the workers are paid 8d. an hour, and at the end of three months receive the men's minimum rate, representing an average of £2 10s. to £3 a week. Aluminium welding is also being taught, and though it is difficult work, the women are doing well in aeroplane factories. The students are booked several weeks in advance of the completion of their training.<sup>4</sup>

<sup>1</sup> Dilution of Labour Bulletin, October, 1917.

<sup>2</sup> Ibid., January, 1918.

<sup>3</sup> Ibid., vol. 2 to 7, April 1918.

<sup>4</sup> "Women's Employment," August 17, 1917.



### MAKING SCIENTIFIC INSTRUMENTS.

In the manufacture of scientific instruments by one large British firm a special point is made of the excellent factory conditions. Largely because a highly educated and most enthusiastic woman is senior charge hand and has inspired her subordinates with her zeal, a high class of women have been obtained by this firm. This is thought to account for the success with which women have there been taught many of the delicate and precise operations.

The women do such accurate work as filing the limbs of sextants—a lengthy process, for the whole surface must be perfectly plane. They assemble practically all parts of sextants, even to the accurate adjustment of the vernier. In the machine shop of this plant women mill and turn such parts as deflection scale rings and turntables for torpedo deflector sights, spot table beds, semaphore wheels, torpedo plates, photoscope boxes and bases. It has been found possible by patience to train several quite young girls for such work. The plant employs 170 women and 75 men, and trained its own force.<sup>1</sup>

### GOVERNMENT RECORDS OF WOMEN'S WORK.

In the Technical Subsection of the Dilution Branch, Labor Supply Department, in Whitehall Gardens, London, is a most interesting collection of information upon the processes, new to women, which they have taken up during the war. No entry is made on the bare intentions of any works. The list extends to the articles or parts produced or the process involved, and to the tools that are operated. Wherever possible a note is taken of the methods employed, the times taken, the previous experience of the women and the arrangements for skilled help and supervision where such are required. Some idea is given of the weight of the object produced, the conveniences for lifting, the type of machine used, the limits of accuracy required and the employment of special facilities, such as jigs. The result is that the ministry of munitions is able to furnish any inquirer with clues to the best way of training, based on actual experience. The section is in fact a Government clearing house of practical experience.<sup>2</sup> The Training and Dilution Service contemplates a similar service for American industries.

The British Ministry of Munitions publishes a catalogue of work executed by women, making up a large body of manufacturing information of interest to engineers of many branches. Works managers are requested by the British minister to compare the times of operations therein reported with the time their own employees take, as well as the methods used, and report any differences with a view to improvement of practices.<sup>3</sup>

It is hoped that the American practices may soon gain similarly as the Training and Dilution Service gathers similar information on manufacturing practices in the United States.

### PART TAKEN BY SKILLED WORKMEN IN TRAINING.

Skilled workmen, under the agreements negotiated between employers and the unions by the Government, were provided by the unions to train the women in many occupations. To these men Mr. Ben H.

<sup>1</sup> Dilution of Labour Bulletin, March, 1918.

<sup>2</sup> *Ibid.*, January, 1918.

<sup>3</sup> *Ibid.*

Morgan, of the British Ministry of Munitions, in an address at Sheffield in October, 1917, paid the following tribute:

A remarkable feature of women's work is the manner in which thousands of them are undertaking operations in the machine shop and the tool room involving the closest mechanical limits of accuracy. This result is not seen in its true perspective if account is not taken of the help that they have received from the men. The skilled workmen who have trained them, giving freely of their life's experience and knowledge, the foreman, the works manager, the director, all do their part in this invaluable improvisation of woman power. To them we look confidently to extend the same help to the thousands of discharged soldiers who are now coming back into the ranks of industry with a claim for preferential employment wherever they can be introduced which it is the policy of the ministry to recognize to the fullest.<sup>1</sup>

#### WOMEN AS TRAINERS OF WOMEN.

Writing in the Dilution of Labour Bulletin for January, 1918, however, a Welsh contributor is of opinion that "it takes a woman to train women if the best work is to be obtained." He continues:

Supposing an employer grasps this, he will go to work very cautiously. Should his business be large enough to give employment to anything over 60 women, an educated forewoman or manageress will repay her cost several times over.

She would first be shown round the works in order to grasp the nature of what is being done, and to get a glimpse of how far women are physically strong enough to succeed on the various jobs. From her notes she would then be able to form a plan of campaign. She would select six women of good physique, coupled with intelligence and character. Having been shown what to do and how to do it, these women would work apart from the men, and during three weeks the manageress and the foreman would have an opportunity to judge their capacity. Should all six women prove efficient, they would be looked on as possible future charge hands. Then would come the time for taking on 10 fresh women laborers and mixing them with the semitrained hands for two weeks. The last stage would now be reached, and the first 12 women would be ready for organizing into gangs, while fresh hands could be drafted into the training ground, under the supervision of four old hands.

The foreman would notify the manageress of his need for a certain number of women, the work to be done, and the probable time it would take. She would select her women, and send them out in gangs of not more than six to a gang, each gang under a charge hand. Thus the time from when the women were first employed to their being sent out in gangs into the works would cover five weeks, and there would be a constant flow of fresh workers being trained and of efficient women laborers being drafted into the works as the need arose.

The manageress would organize the women's dress and their breaks for food and rest other than the recognized official dinner hours. She would judge between a feigned strain or illness and a real one; and, having engaged the workers, would undertake the general discipline during work. She would, for instance, cope with the beginner's habit of stopping between each two or three spadefuls, a habit that is far more catching than any germ in creation.

Should the works be too small to employ over 30 women, another plan must be adopted. The firm should choose as a start four women of good working class type and over 35 years of age. After they have worked together for two or three weeks, it will be possible to appoint one as a working forewoman or charge hand, while new hands should be engaged and trained to their tasks very gradually in small numbers under the other three. The foreman would give his working forewoman all work orders and make all complaints to her. She would work, as a rule, with the largest gang, and would break off occasionally to visit the various groups of workers. The mess room and its tidiness would be in her control. She would not dismiss or engage any woman, but would act as a go-between for conduct, health, time-keeping, and the amount of work done. She would be greatly assisted in such work if her authority was recognized in rules made by the manager. The firm would find it essential to stop any women working in mixed gangs, and also to insist on the women wearing boiler suits.<sup>2</sup>

<sup>1</sup> Dilution of Labour Bulletin, November, 1917.

<sup>2</sup> Ibid., January, 1918.

This article refers to employment of women in heavy labor at Welsh firebrick and furnace plants.

#### SUMMARY OF TRAINING RESULTS IN LONDON.

There was until the war ended a demand for more women to take up training in order to qualify for entry to munition factories, where shells, aeroplane parts, and other war-time necessities were made. Some very interesting figures have recently been reported to the Education Committee, London County Council, of the work done in training munition students.

During the last two years, out of some 6,000 students who passed through the course of training satisfactorily and received certificates, 5,750 are known to have obtained employment on work of national importance. This record shows that the value of training is recognized generally by employers, and that a trained student will soon find a suitable place for her abilities.

There are two main centers in London equipped with modern machine tools—one in Shoreditch, serving North London, and the other in Brixton, serving South London. The equipment includes machines for turning, milling, grinding, profiling, etc. In these two centers the number of women trained has steadily increased. The nature of the training has altered in character from the earlier efforts to train operators to the training of setters-up, turners, oxy-acetylene welders, assemblers, and tracers. There are now comparatively few persons being trained as operators. There are vacancies in the various classes and a considerable number of women are needed each week to meet the demands for trained workers.

Attendance is required for eight hours a day on six days a week. Arrangements have now been made that women who take up training in special machine work or specialized courses receive a maintenance allowance of 25s. per week from the beginning of their training. During the first week they are expected to show their capacity for the work, and if they pass this initial stage satisfactorily they receive this payment until they complete their course. Upon the satisfactory completion of the course and when arrangements have been completed for transfer to the factory, a further allowance of 25s. will be payable.

All students are provided with caps and overalls, which will remain the property of the training school. No charge is made for the training. Applications for admission to the training classes are addressed to the Education Officer, London County Council Education Offices, Victoria Embankment, W. C. 2.

#### EXHIBITION OF WOMEN'S WORK AT BIRMINGHAM.

The rapid adaptation of women to new work was illustrated at an exhibition in Birmingham of what has been done in training schools.

For the most part the training-school exhibits referred to machine work, although specimens were also shown of tracing, acetylene welding, woodwork, etc. In this respect the exhibit represented only part of the activities in these institutions, which undertake training in many other branches of work; but in those branches with which it dealt it gave a particularly instructive and interesting display, which attracted considerable attention and inquiry. It covered the productions of pupils



from the training of a few days, in which they learned to produce a simple job on machines such as plain millers, up to a period of 4 or 5 months, which is found sufficient to enable suitable pupils to do gauge work to the very closest limits of accuracy. A typical example of what may perhaps be regarded as the average training that is usually sought was a small screw jack the body of which, with its internal square thread, was made in 8 hours after 6 weeks' training; the screw in 2 hours after 3 weeks' training; the cap in  $1\frac{1}{2}$  hours after 4 weeks' training. In every case the women set their own tools under the supervision of skilled instructors, and this feature appears to be a routine and habitual part of the training of many of the pupils. A set was shown, for instance, of 6 screws, etc., made on capstan lathes, involving from 5 to 7 operations each, the tools for which were set by pupils after 4 weeks' training. The shortness of the time within which women could be taught to work to close limits was exhibited by a number of examples. A seven-eighths inch reamer, for instance, was shown roughed out and finish-turned to a limit of 0.005 inch in  $1\frac{1}{2}$  hours by a pupil of 2 weeks' training, and ground and sharpened to a limit of 0.0005 inch by a pupil of the same standing. A few of the other products of the training may be instanced at random from the exhibit, with the remark that they are all typical and not exceptional. Machine-tool parts are turned, milled, drilled, and tapped, women setting their own tools, after 2 to 5 weeks according to the operation in question; a slide-rest screw, five-eighths inch diameter, with 6 threads, is rough-turned, finish-turned, and the thread cut in 4 hours after 5 weeks' training; a gear wheel, 8 pitch, 30 teeth,  $1\frac{1}{4}$ -inch face, is drilled, bored, and finish-turned on the mandril in 4 hours after 5 weeks' training, and the teeth cut on the miller in 3 hours after 3 weeks' training; a differential screw  $1\frac{1}{4}$  inches and 1-inch right and left hand cut in 5 hours after 5 weeks' training; the women setting their own tools in each case. Gauges, both flat and screwed, were shown in every stage of manufacture up to master gauges for the use of the National Physical Laboratory for the contour of a driving pin, made by a woman after 5 months' training to light-tight accuracy without measurable limit, and a number of other gauges finished (filed and lapped) to 0.0002 inch by girls who have been trained from 2 to 3 months. Apart from shell and fuse work, of which many specimens were shown, and on which whole factories are being run by women alone, specimens were shown of work as various as motor-plough gear boxes, bolts for turbine cylinders, parts of mine mechanism, motor and aero engines, aircraft parts, chucks and vices, magneto parts, sheet-metal work for aeroplanes, etc., and a variety of tools, punches, dies, and gauges. A large number of the pupils are taught to set up their work from blue prints. The pupils and workers in these training schools and instructional factories are mainly women, and the balance almost entirely discharged soldiers.

The fact that women could be trained rapidly to set their own tools was so new as to be credible only on the strength of the repeated and various examples that the exhibition disclosed.<sup>1</sup>

### TIME, WAGES, AND NIGHT WORK.

Certain conclusions have been reached by British authorities as a result of war time experiences with respect to wage scales at time or

<sup>1</sup> Dilution of Labour Bulletin, D. A. Section (Dilution), Ministry of Munitions, vol. 2, No. 3, December, 1917.

piece rates. The advantages and disadvantages of night work for women were also considered.

Dr. Vernon was able to make valuable tests by comparing the performances of girls on continuous or discontinuous day or night work in the same factory, and found that the comparison was not unfavorable to the discontinuous system, with weekly changes.<sup>1</sup>

It was found that although good output can undoubtedly be obtained by a system of time wages, yet under suitable conditions, particularly for monotone repetition work, increased output can be obtained by well-arranged piece rates.<sup>2</sup>

An investigator for the United States Department of Labor reports:

The scheme of paying a minimum sum as a time wage for all output below a certain standard (always presuming this standard is fixed well within the powers of the workers) and piece rates for work done in excess of that standard commends itself to the committee as a useful method for removing mental strain from a worker who on account of feeling fagged may be overanxious as to her capacity for earning a bare livelihood. Such a worker, with this strain removed, may end by producing a full week's work; with it present, an injudicious effort may result in an unnecessary breaking down. And the committee have noted with satisfaction that in the first schedule of the Munitions Order No. 1, dated September 13, 1916, it is laid down that "the appropriate time rate shall in the case of any woman or girl on piecework or premium bonus system, be guaranteed and paid."<sup>3</sup>

Some special points of interest which emerged from the findings at certain factories are worth recording:

- (a) Effect of factory life on married women.
- (b) Length of service in relation to strain.
- (c) Relation of age of workers to fatigue shown.
- (d) Eyestrain in relation to factory employment.

(a) Effect of factory life on married women was observed in two medical examinations carried out at Factory No. 4 within six months of each other. In the first case 210 workers were examined, and in the second 116 of the same women were seen again. The married women reexamined at the factory included 31 per cent who mentioned difficulties in home conditions or suffered from the strain of night work, as they often obtained too little sleep during the day. Chronic rheumatism occurred in 12 per cent. Ten women had remained quite healthy; these included young women either without children or who undertook no household duties, and a proportion of elderly women of over 40 years of age, of the charwoman type, who were especially strong and wiry. Several mentioned the improvement which had resulted from their being given work at which they could sit instead of having to stand, and some had ceased night work.

Married women interviewed in their homes had left the factory for reasons of health in 26 per cent, or on account of low wages and long hours in a similar proportion (26 per cent). Some had secured work in other factories in the district where no Sunday labor was required. An additional 15 per cent had left on account of pregnancy, and 15 per cent had ceased going out to work either for health reasons or for home affairs. One case could not be traced, and one worker had left on account of chronic rheumatism.<sup>4</sup>

## WAGES IN GENERAL.

The following data are available regarding pay in British factories:

Wages for women of 18 years or over engaged upon unskilled and semiskilled work were \$4.87 per week (£1). Women trained at technical schools in munition work receive 25 shillings, or \$6.08. For piece work about 25 per cent is the overtime rate.<sup>5</sup>

<sup>1</sup> U. S. Labor Bulletin, No. 230, p. 18.

<sup>2</sup> Ibid. p. 99.

<sup>3</sup> Ibid., p. 105, sec. 19.

<sup>4</sup> Ibid., p. 171, sec. 14.

<sup>5</sup> See U. S. Labor Bulletin, No. 223, p. 71.

Men in machine shops receive \$20 a week, and if away from home \$4.50 a week additional, making a total of \$24.50 a week.

Women receive the same wage for the same skilled work. When a woman was substituted for a man on unskilled or semiskilled work she was paid two-thirds of the man's wage. Only about 30 or 40 per cent of the total number of women employed in industry receive this lower rate. Women on shell work received 15 shillings per week before the issuing of order No. 2 by the ministry of munitions, which fixed the rate at 20 shillings and 23 shillings during training; 25 shillings after 5 weeks training; and 27 to 30 shillings 6 pence when assigned.<sup>1</sup>

Time pay of women employed on work usually done by men:

48 hours.....	£1
49 hours.....	£1 0s. 6d.
50 hours.....	£1 1s.
51 hours.....	£1 1s. 6d.
52 hours.....	£1 2s.
53 hours.....	£1 2s. 6d.
54 hours.....	£1 3s.

### SHEFFIELD CUTLERY AGREEMENT.

An example of wage scales in detail is presented herewith.

At a conference of representatives of the Sheffield Cutlery Manufacturing Association and the Sheffield Amalgamated Union of Labor, acting on behalf of Spring Knife Grinders and Cutlers, held at Sheffield on November 13, 1916, at the instance of the Home Office, under the chairmanship of Mr. C. F. Wright (His Majesty's superintending inspector of factories), the following agreement was concluded:

#### 1. Definition of women's work.

(a) Women may be employed on the following operations:

1. Blades, shaping, tongs, squaring, boring.
2. Springs, hardened, tempered, bored and shaped.
3. Inside webs shaping and boring.
4. Scales shaped, bored, and pinned on.
5. Bolsters pinned on with scales.
6. Covering of all kinds shaped and bored, including shadows.

(b) The employers undertake on their part to introduce modern machinery and up-to-date methods of production. To secure that all material handed to the cutlers is true, accurate, and ready for building the knife.

#### 2. Rates of wages for unskilled females.

1. Starting wages for unskilled workers:

- (a) Up to 16 years of age, 8s. per week.
- (b) After 6 months' service, 9s. per week.
- (c) After 12 months' service, 10s. per week or scale.

2. Starting wage for unskilled workers:

- (a) Between 16 and 17 years of age, 8s. per week.
- (b) After six months' service, 11s. per week.
- (c) After 12 months' service, 14s. per week or scale.

3. Starting wage for unskilled workers:

- (a) Between 17 and 18 years of age, 10s. per week.
- (b) After 6 months' service, 13s. per week.
- (c) After 12 months' service, 16s. per week or scale.

4. Starting wage for unskilled workers:

- (a) 18 years or over, 12s. per week.
- (b) After 6 months' service, 14s. 6d. per week.
- (c) After 12 months' service, 17s. per week.
- (d) After 18 months' service, to scale.

#### 3. Rates of wages for skilled females:

(a) The term "skilled" shall apply only to those who have had twelve months or more actual working experience in the trade.

<sup>1</sup>Order 49, Circular 2, January 24, 1917.



3. *Rates of wages for skilled females*—Continued.

- (b) The undernoted rates to be paid:
- 14 to 16 years, 10s. per week.
  - 16 years, 12s. per week.
  - 16½ years, 13s. per week.
  - 17 years, 14s. per week.
  - 17½ years, 15s. per week.
  - 18 years, 16s. per week.
  - 18½ years, 17s. per week.
  - 19 years, 18s. per week.
  - 19½ years, 19s. per week.
  - 20 years, 20s. per week.
- (c) When piecework rates are paid, they shall be the same as paid to men.
4. Weekly working hours: The above scales are based on a 50-hour week.
5. Productive work only: The above rates are for productive work only, and do not apply to warehouse hands.
6. Date: The terms of this agreement shall come into operation on and from Monday, December 11, 1916.

## TABLE AND BUTCHER KNIFE SECTION.

At a conference of representatives of the Sheffield Cutlery Manufacturers' Association and the Cutlery Union, held at Sheffield on the 1st of December, 1916, at the instance of the home office under the chairmanship of Mr. C. F. Wright (His Majesty's superintending inspector of factories), the following agreement regarding the employment and remuneration of female labor in the table and butcher knife trade and allied branches was concluded:

1. Work on which employed: There shall be no restrictions in the class of operation to be performed.
2. Rates of wages for unskilled females:
- The undernoted rates to be paid:
  - Starting wages for unskilled workers:
    - Up to 16 years of age, 8s. per week.
    - After 6 months of service, 9s. per week.
    - After 12 months of service, 10s. per week or scale.
  - Starting wages for unskilled workers:
    - Between 16 and 17 years of age, 8s. per week.
    - After 6 months of service, 11s. per week.
    - After 12 months of service, 14s. per week or scale.
  - Starting wages for unskilled workers:
    - Between 17 and 18 years of age, 10s. per week.
    - After 6 months of service, 13s. per week.
    - After 12 months of service, 16s. per week or scale.
  - Starting wages for unskilled workers:
    - 18 years of age and over, 12s. per week.
    - After 6 months of service, 14s. 6d. per week.
    - After 12 months of service, 17s. per week.
    - After 18 months of service, to scale.
3. Rates of wages for skilled females.
- (a) The term "skilled" shall apply only to those who have had 12 months or more actual working experience in the trade.
- (b) The undernoted rates to be paid:
- 14 to 16 years, 10s. per week.
  - 16 years, 12s. per week.
  - 16½ years, 13s. per week.
  - 17 years, 14s. per week.
  - 17½ years, 15s. per week.
  - 18 years, 16s. per week.
  - 18½ years, 17s. per week.
  - 19 years, 18s. per week.
  - 19½ years, 19s. per week.
  - 20 years, 20s. per week.
4. Weekly working hours: The above scales are based upon a 50-hour week.
5. Allowances: The question of reasonable allowances for the preparation of material shall be taken into consideration by both parties.
6. Date: The terms of this agreement shall come into operation on and from Monday, November 27, 1916.

### MINISTRY OF MUNITIONS. ORDER NO. 546.

Order No. 546 of the Ministry of Munitions dated May, 1918, considers certain problems affecting wages of men and women workers.

The following is a summary of the order:

Difficulties having arisen out of the comparison, in establishments wholly or mainly engaged on aircraft work, between the rates paid to women on wood work and the rates paid on certain classes of metal work, it has been decided that in such establishments no women employed as time workers should receive less than 6d. (12.2 cents) per hour after eight weeks. The rate of wages fixed vary according to the class of work and, in most cases, the age and experience of the worker.

On work of a class which, prior to the war, was customarily done by men, a minimum time rate of 6d. (12.2 cents) per hour, or 24s. (\$5.84) per week, plus an advance of 6s. (\$1.46) per week, is fixed, with the provision that on work done by semiskilled men the payment shall be adjusted according to the nature of the work and ability of the women, and that women employed on work customarily done by fully skilled tradesmen shall be paid the time rates of the tradesmen whose work they undertake.

Women undertaking part only of the work customarily done by fully skilled tradesmen are to serve a probationary period of three months, during which they are to be paid at gradually rising rates until, at the end of the period, they attain the district time rate for the skilled tradesmen whom they replace, less a deduction (not exceeding 10 per cent) in cases where additional cost is incurred, through extra setting up or skilled supervision, owing to the substitution of women for men.

For girls under 18 years of age employed as time workers on work customarily done by men the rates fixed range from 14s. (\$3.41) per week at ages under 15, with a working week of 48 hours or less, upward to 23s. (\$5.60) at 17 years with a 54-hour week, with an advance of 3s. (73 cents) per week in addition in each case.

Women employed on such work at piece rates are to be paid the piecework prices customarily paid for the same or similar work when done by men. In the case of girls under 18 a percentage deduction from these prices is fixed, varying according to age.

For work of a class which, prior to the war, was not recognized as men's work the time rates vary from 2½d. (5.1 cents) per hour, plus an advance of 3s. (73 cents) per week, for girls under 15, to 5½d. (11.2) per hour, plus an advance of 6s. (\$1.46) per week, for women 18 years and over. During a probationary period (not to exceed one month) they may be ½d. (1 cent) per hour less.

### EMPLOYMENT OF MAIMED SOLDIERS.

In view of the importance attached in the ministry to using the services of disabled men to the utmost, a requirement is likely that applications for additional labor must be accompanied by a sufficient statement of the nature of the jobs to determine their suitability for maimed soldiers.

Such requests for information from employers will naturally suggest inquiry as to what work can be done by disabled men. No answer can be given in general terms. It depends partly on initial skill and perseverance and partly on the nature of the injuries, and, accordingly, it varies from nothing up to the full ability of the best class of men.<sup>1</sup>

### METHOD OF TRAINING CRIPPLED MEN.

Men who have been crippled from their youth are selected by the British Government as training instructors for maimed soldiers who must be given an industrial education, says the Dilution of Labor Bulletin for December, 1917. Such men have a first-hand knowledge of the limitations and difficulties of those whom they are training, and are said often to have devised ingenious ways to overcome or reduce their handicap.

<sup>1</sup> Dilution of Labour Bulletin, D. A. Section (Technical), Ministry of Munitions, Vol. II, No. 1, October, 1917.

It has been found advantageous, before selecting a trade for a maimed man, to apply certain general tests to ascertain his existing attainments and to take careful account of his previous occupation. Good results have been obtained in training maimed men in various branches of wood work, such as cabinet making, last making, and general carpentry. A man with one hand and an artificial arm—which for this purpose need only be a hook—can act quite efficiently as a planer or band-saw feeder. A man who has lost both legs can do box nailing and any hand repair work which is brought within his reach. Cabinet making, with its large proportion of hand work and the high quality of workmanship that can be utilized, is especially adapted to men who have lost a leg.

Maimed men have done extremely well at laboratory work and in chemical plants upon processes requiring high personal qualifications such as care, attention, trustworthiness, and accuracy, but little physical strength or manipulative skill. Even a man who has lost both legs and an arm has been found useful and thoroughly efficient in operating a private telephone exchange.

Such men should be passed through an instructional factory, or vestibule school, where they can be sure of tolerance and individual attention, in order that they may acquire, or reacquire, the habit of shop discipline.<sup>1</sup>

#### WORK ON SPECTACLE LENSES.

A firm engaged in the manufacture of spectacle lenses began to add discharged soldiers to their staff about a year ago in preference to women. They arranged to obtain a few men at a time from the Soldiers and Sailors' Help Society.

A slightly disabled soldier was brought back from the colors to teach these soldiers the work, with the agreement that as each pupil goes on piecework the teacher gets £1 as remuneration. For two months, while the men are learning the particular type of work required, they are paid 30s. a week, after which they are given the same piecework rates as the other men in the shop.

Arrangements were made by which the spindles, usually made of cast iron, on which the lenses are fixed during the polishing process, were replaced by aluminium, so that the weights to be lifted by men were reduced. In this way men who have injuries to the leg or have lost a leg are available for the work as long as they can use their hands. If expansion occurs in the future, the employer is prepared to arrange his glass shop in such a way that men can sit at their work.

The first soldier started work about a year ago, and at the end of nine weeks was earning from £2 to £2, 5s. per week. Of the first four men employed, three were satisfactory, and it was reported that they had proved to the other men of the shop that the operation of glass grinding and polishing was not nearly such skilled work as they imagined. Two months ago the firm had 12 men of this type in their employment. The employers find them entirely satisfactory and hope to add to the number at an early date. One employee is earning over £4 per week after four months' training.<sup>2</sup>

<sup>1</sup> Dilution of Labour Bulletin, December, 1917.

<sup>2</sup> See Dilution of Labour Bulletin, D. A. Section (Technical), Ministry of Munitions, Vol. II, No. 1, October, 1917.



### DISABLED MEN IN FURNITURE TRADE.

Certain conclusions have been reached in England regarding the employment of disabled men in the furniture trade.

Lining or marking out timber is done in many cases by men with an all round knowledge of the trade, but some shops afford an opening for disabled men. Such men would be under the supervision of the foreman in charge of the timber yard or machine department.

If arrangements are made to bring the planks to the liners this work should be suitable for one-legged men. There are four or five men in such a shop usually.

#### MACHINE WORK.

Many machines that do light, simple processes are quite safe to use, and have guards or fences to protect the workman. The saws, cutters, plane irons, etc., are in charge of a skilled workman, who is responsible for setting and sharpening.

A comparatively short training should enable a man to operate an ordinary machine quite satisfactorily.

Where effective guards are provided most machines are such that one-legged men or men injured in the leg could operate them without difficulty. Spindle machines, however, are dangerous for a man not firm on his feet, and overhand planers and circular saws are not advisable for crippled men.

In work on the vertical borer, fret saw, and carving machine it should be possible to allow the operators to sit.

Machinists require the full use of both arms; also good hearing is a help to detect whether the machine is running properly or not. Machine-shop work is unsuitable for men suffering from neurasthenia, shell shock, and chest complaints.

Similar generalizations hold for cabinet and chair making, carving and inlay, sand papering by hand, French polishing, and upholstery.

Demands for disabled men have been received in all parts of the country.

Tracing, drawing, and designing is entirely sedentary work, most suitable for men disabled by leg or thigh injuries, deafness, neurasthenia, shell shock, chest complaints, or rheumatism.

In training disabled men for the furniture trade, the time of training is divided into a probationary period and an improver's period. The wages for the probationary period are nothing for the first four weeks. Afterward they are 10s. a week. In the first half of the improver's period the pay is 15s. a week, and in the second half 20s. The length of each period is the same. Only specially gifted men are chosen for drawing and designing, and each period of training is a full year. In carving and inlay, upholstery, French polishing, and cabinetmaking each period is 26 weeks. In chair making, machine work, wood turning, and lining or marking the training periods are 12 weeks each, and in sandpapering by hand, glass beveling by machine, surface polishing or mirrors, and cleaning, coppering, varnishing, and silvering mirrors (not silver mixing) the periods are only four weeks each. The first month of training (without pay) is a trial period, during which the suitability of men for the work is discovered. Those not adapted to it are not trained further.

The training without pay, however, is not a hardship upon the men. In cabinetmaking, for example, a disabled man without children would

receive during these four weeks 27s. 6d. from his local war pensions committee, and this allotment would decrease as he began earning in the factory. Skilled adult male workers in the trade receive from 9d. to 1s. 3d. per hour, according to locality.<sup>1</sup>

### WELFARE WORK IN BRITISH MUNITION FACTORIES.

The British health of munition workers committee was appointed September, 1915, by the minister of munitions, with the concurrence of the Home Secretary, "to consider and advise on questions of industrial fatigue, hours of labor, and other matters affecting the personal health and physical efficiency of workers in munition factories and workshops."

This committee took evidence in various industrial centers from employers, representatives of workers, and other interested persons, and made numerous special studies and investigations. It also visited a large number of factories and workshops. It was formed of doctors and men of various technical experience, and the report covers Sunday labor, hours of work, information concerning output in relation to hours of work, industrial fatigue and its causes, diseases, ventilation, and many other vital subjects.<sup>2</sup>

Great Britain realizes, as a result of the war, the desirability of dispensing with manual labor where machines can serve better. An Englishman writes:

A surprisingly large amount of production still takes place in small workshops; and the presence of small workshops, side by side with great factories, creates some of the most awkward difficulties in the way of social reform. Still the factory (mill or works) occupies by far the larger part of the industrial field, and constitutes the characteristic industrial problem of our days, and therefore it is important to realize what it means and what it involves. It means, to begin with, the performance of mechanical work by what we significantly call "power"—i. e., non-human power—steam or electricity. Muscular effort—the effort of lifting, carrying, pushing, thrusting, cutting, and the like—is almost entirely replaced by the performance of machinery. The human agent becomes simply the "tender," in many cases the mere watcher of the machine. Wherever to-day in a modern works we find men or women engaged in hauling heavy things about, we can not help feeling that it is out of keeping with the mechanical spirit of the age. \* \* \* The modern idea is to get the things shifted by mechanical transmitters.

The machine, by removing the strain from muscle, makes industrial employment possible on a vast scale.<sup>3</sup>

### CLOTHING FOR WOMEN WORKERS.

A direction by the ministry of munitions setting forth the best type of protective clothing for women workers in the interest of safety recommends that female workers "should be supplied by the employers with caps and overalls and that suitable arrangements should be made for the necessary washing of these."

A standard type of overalls has been devised and protective clothing suitable for practically every kind of work on which women are employed. Two caps and two overalls are allowed each woman.

Under date of January 31, 1916, the ministry of munitions established a special department, under the direction of B. S. Rawntree, to give effect to the policy of the ministry with regard to welfare supervision,

<sup>1</sup> Reports upon openings in industry for disabled soldiers and sailors; No. 5, Furniture trade.

<sup>2</sup> "Summary of Committee's Conclusions," U. S. Labor Statistics Bulletin No. 222, April, 1917.

<sup>3</sup> Economic Journal, December, 1916; Address by Prof. W. J. Ashley.

especially with regard to women. It is the duty of this department to render employers every assistance in devising schemes, considering arrangements most suited to meet particular needs, and suggesting (if desired) the names of ladies qualified to act as welfare supervisors.

#### DUTIES OF LADY SUPERINTENDENTS.<sup>1</sup>

When lady superintendents were first appointed in factories, they were given no official position. They were responsible solely to the employer, not to the ministry of munitions.

Now they have a definite position in the business organization, and considerable responsibility for the control of the working staff.

If suitable persons have been chosen for this task, employers generally find them very valuable, especially where large numbers of women are employed. Not a few experienced manufacturers regard them as among their most important officials.

The following notes show the principal duties actually allotted to lady superintendents in some of the establishments where they have been most successfully employed.

#### POSITION.

The lady superintendent should act in accordance with instructions from the general manager, and refer to him in all matters of difficulty. It is important that she should not be placed under the authority of subordinate officials. She should, therefore, be a person whose qualifications and personality fit her for responsibility, and are such as to command the respect of the operatives and foremen.

#### DUTIES.

##### *1. Assistance in the engagement of workers and in the appointment of overlookers.*

The selection of all women and girls for employment is often undertaken in the first instance by the lady superintendent. If, however, it is desired that the overlooker or other person responsible for the work from the technical point of view should actually engage the women and girls required, the choice should be made from among those so selected.

When this duty is intrusted to a lady superintendent who is capable of making employees feel that they are not mere tools, but human beings whose conduct, effort, and influence really count in the factory, inestimable benefit results. To-day a few well-chosen words from such a superintendent as to the part played by women when their country is at war can hardly fail to be helpful to women munition workers. The engagement of employees by a lady superintendent furnishes a valuable connecting link between the business side of the factory and the "social side."

It is also important that these officers should be consulted before overlookers are appointed; for, while the manager will consider especially the technical ability of anyone it is proposed to appoint, the lady superintendent will consider her character and probable attitude both to her colleagues and to the girls.

##### *2. Keeping records of broken time.*

She should keep careful records of broken time and seek to remove its causes, whether these lie in the factory or outside it.

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<sup>1</sup>Sometimes called "lady welfare supervisors."



### *3. Investigation before dismissal and in cases of resignation of employees.*

It is advisable that the lady superintendent should be consulted before employees are dismissed and an intimation received from her that the dismissal is justifiable. In this way dismissals due to hasty action on the part of overlookers are guarded against, and much dissatisfaction among workers is prevented.

When a girl gives notice, the fact should be reported to the lady superintendent, so that she may get at the real reason for leaving. Inquiry may bring to light some undesirable practices or conditions. The lady superintendent might with advantage be consulted about all disciplinary methods adopted in the factory so far as they affect women workers.

### *4. Watching the wages.*

While the lady superintendent should have no responsibility for fixing wages, she should have facilities for knowing the wages each girl earns. It frequently happens that injustice is done to a worker in the matter of wages, inadvertently and quite unknown to the management (e. g., through a pieceworker being kept waiting for work, etc.). If the lady superintendent has the duty of watching for any possible causes of complaint and drawing the attention of the management to them promptly, serious discontent among the workers may often be avoided.

### *5. Investigation of complaints made by the workers.*

The lady superintendent should deal immediately with all complaints relating to factory conditions, and refer those relating to hours, overtime, shifts, wages, etc., to the general manager or other officials, according to the nature or importance of the complaint.

This may perhaps appear liable to undermine the power of the managers and forewomen, but experience shows that where tact is used this is not the case. Where the complaint is one which should have been made to the forewoman, she will instruct the workers accordingly. On the other hand, it is an immense advantage for every worker to know that she is at liberty to make complaint, either written or oral, to the lady superintendent, who is presumably a person of sympathy and understanding, capable of realizing not only the workers' point of view but those of the forewomen and of the firm.

### *6. Supervision of the working conditions.*

The lady superintendent should notify the responsible officials in case of bad ventilation, under or over heating, or want of cleanliness, and see generally that the workrooms are kept in a satisfactory condition from the point of view of the health and comfort of the workers, a consideration very necessary to business efficiency. She should watch the kind of work upon which the women or girls are engaged, and draw the attention of the official responsible to any work which she thinks unsuitable. She should also inform the management if she considers that seats should be provided in the workrooms or elsewhere. She should supervise cloakroom and lavatory accommodation and see that it is adequate, cleanly, and suitably controlled, and that the arrangements made with regard to the provision of overalls, caps, shoes, towels, and other accessories are satisfactory.

### 7. *Night supervision.*

Close supervision of women and girls working at night is a most important duty of the lady superintendent. Ordinary factory oversight is often somewhat lax during the night shift, but where women are employed careful supervision is especially necessary.

### 8. *Supervision of canteens and rest rooms—Cooperation with doctors and nurses.*

She should supervise the canteen arrangements. Where the canteen is managed directly by the firm, it will probably be found advisable to place it under her control; but where an outside agency is managing it, she should see, on behalf of the firm, that it is satisfactorily controlled. She should also supervise any rest rooms or recreation rooms, and should be in effect a general health inspector, with a view to remedying any causes of illness or physical inefficiency connected with the conditions of work, excessive hours, etc. She should cooperate with the medical and nursing staff, if any, and otherwise should herself take charge of the arrangements for rendering first aid.

### 9. *Supervision of housing and transit.*

She should acquaint herself with the conditions under which the workers are housed and with the transit facilities provided for them, and inform the manager if she considers either to be inadequate or unsatisfactory. She should help girls coming from a distance to find suitable lodgings.

### 10. *Recreation, etc.*

In war time especially it is very desirable that the workers should have suitable outdoor and indoor recreation, and the lady superintendent may in many cases advantageously organize and supervise a recreation club. In some cases it is desirable that she should visit women who are ill, etc.

The appointment of a lady superintendent means in effect that the manager of a factory says:

"I want to be satisfied that the women and girls I employ are working under good conditions, but I myself have no time to enter into every detail. I therefore appoint a lady superintendent, or a staff of superintendents, and I expect them to act for me in trying to insure a satisfactory state of things. I wish them, as a rule, to be guided by their own tact and common sense, but to come to me when any defect can not otherwise be remedied."

Experience shows that the manager who adopts this line finds that lady superintendents are no mere luxury. On the contrary, they perform a most useful service; they relieve the management of a large mass of difficult detail, and they increase the firm's output by promoting the health, efficiency, and happiness of the workers.

## WELFARE COMMITTEE OF THE MINISTRY OF MUNITIONS.

The well-being of the workers was considered by the welfare committee of the ministry of munitions with respect to workrooms, food, hours, wages, amenities, health precaution, supervision, individual consideration, recreation, transit facilities, hotels and lodging, and supervision outside of factory.

Traveling officers were appointed to visit factories, investigate, and report.

### LABOR POLICIES AFFECTING WOMEN.

A number of changes have been found necessary in the methods of handling materials where women are employed. Men ordinarily do lifting and heavy work, and women look after machines only. Women are employed as assistants to skilled men.

Tackle is used to lift beams in and out of frames, and wheeled trucks or smaller loads are given women to handle.

Day work only is the rule in many places, so far as women are concerned. Subdivision of work, rearrangement of work, and skilled supervision make the employment of women more convenient.

Waterproof aprons, special clothing, and lighter tools are essential. Work is sectionalized, hours reduced, and machines are run by electricity instead of steam. Automatic lifts have followed the entrance of women into industry.

Stock supplies are kept of made-up chemical solutions. In handling leather, hides are slung over sticks, so that less hooking is required. Trolleys are used in many places to save carrying, and automatic machines are utilized wherever possible.

In glass work, mechanical blowers have been introduced. The aerograph, pentagraph, and use of templates have all aided in making work better suited to women.

### WOMEN'S WORK IN ENGLAND.

Women have been employed in many occupations in England that are not considered suitable in this country. The depleted man power abroad necessitated more drastic measures there, perhaps, than may ever be required here.

In general, the view of the United States Department of Labor is that women should not be employed in jobs that require heavy lifting or excessive physical strain of any kind, or in work that may lead to physical deterioration or to any impairment of the duties of motherhood. The welfare of future generations as well as the present is at all times considered.

The following list of women's occupations in England is presented as a matter of record, but many of these occupations are not indorsed by the Department of Labor as suitable:

*Detailed list of processes in which women are employed.*

#### CHEMICAL TRADES.

##### *Candles.*

Bleaching wicks.  
Casting dips.  
Doubling wicks.  
Making night light cases.  
Molding department. (Filling, winding up, and emptying.)  
Packing.  
Plaiting wicks.  
Putting wicks on night lights.  
Scraping blocks of paraffin wax.  
Stamping name on candles.  
Trucking.  
Winding wicks.

##### *Chemicals for tanning textiles and other trades.*

Bricksetter's laborer.  
Digging out and placing in dishes.  
Discharging and loading on the tip.  
Emptying coolers.  
Feeding and tending elevators.  
Loading ashes, etc., into barges, trolleys, and wagons.  
Mixing for furnaces.  
Packing.  
Shoveling into chute.  
Varnishing kegs.  
Yard laborer.



## CHEMICAL TRADES—continued.

*Drugs, fine chemicals, etc.*

Attending boiling pans.  
 Bottle washing.  
 Coating photographic plates.  
 Crystallizing.  
 Laboratory work.  
 Making gum.  
 Packing patent medicines.  
 Pill making.  
 Removing jubes from tins.  
 Scent making.  
 Shampoo powder making.  
 Warehouse work.  
 Weighing up in coating room.  
*Heavy chemicals (salt, soda, and alkali).*  
 Blue beds.  
 Laboring.  
 Shaking bags.  
 Stacking.  
 Sweeping.  
 Taking from presses and putting on racks.

*Manures and fertilizers.*

Feeding elevators.  
 Taking bags from chutes.  
 Weighing bags of manure.  
 Wheeling barrows.

*Matches and fire lighters.*

Box and case making.  
 Chopping up fire lighters.  
 Tin lining.  
 Tray carrying.  
 Veneering.

*Oil, oil seed cake, seed crushing.*

Antifouling and anticorrosive compounds (manufacturing of).  
 Armour injection compound (manufacturing of).  
 Attending filter presses.  
 Auto bag filling.  
 Cake breaking.  
 Chalking up.  
 Cleaning hydraulic presses.  
 Enameling barrels.  
 Filling bags and cans with meal or nuts.  
 Laboring and light trucking.  
 Locust cutter.  
 Maize bruising.  
 Mechanical cooperage.  
 Painting cans.  
 Press shop.  
 Riddling over screens.  
 Sealing cans.  
 Sewing up bags.  
 Stacking small tins.  
 Sticking.  
 Weighing.

*Paints, colors, and varnishes.*

Color mixing.  
 Feeding granite rolls.  
 Filling tins and barrels.  
 Filling varnish; attending Roberts's or other filling machines.  
 Grinding; attending cone or roller mill.  
 Labeling and stenciling packages and tins.  
 Mounting shade or color cards.  
 Packing.  
 Painting kegs and drums.  
 Screwing down.  
 Soldering, washing, and dipping tins.  
 Warehouse work.

*Soap.*

Can filling (with liquid and soft soap).  
 Carrying fob (in soap boiling department).  
 Carrying and emptying cases in melting house.  
 Crutching machine (attending).  
 Cutting into bars.  
 Drying toilet soap.  
 Drum filling (with glycerine).  
 Loading vans.  
 Milling.  
 Mixing machine (tending).  
 Packing.  
 Plodding.  
 Regulating fall pipe (in soap boiling department).  
 Rolling full and empty barrels (in melting department).  
 Scraping resin off barrel staves.  
 Shredding toilet soap.  
 Stamping (hand and machine).  
 Trimming toilet soap.  
 Trucking.  
 Wrapping.

*Starch, glue and polishes.*

Box making.  
 Cutting glue.  
 Drying.  
 Emery cutting.  
 Emery and glass washing.  
 Feeding hopper.  
 Filling bags.  
 Filtering.  
 Grinding.  
 Milling.  
 Mixing blue.  
 Mop making.  
 Packing.  
 Press work.

## CLOTHING TRADES.

*Boots and shoes.*

Clicking department:  
 Clicking presses.  
 Hand clicking.  
 Marking machines.  
 Measuring machines.

*Boots and shoes—Continued.*

Clicking department:  
 Pattern cutting.  
 Sorting.  
 Splitting machines.

## CLOTHING TRADES—continued.

*Boots and shoes*—Continued.

## Closing department:

- Beading and folding machines (Booth duplex, etc.).
- Benchwork.
- Buttonhole machine (Reece, etc.).
- Cylinder golosh.
- Ensign lacer.
- Eyeletting machine.
- Flat machine.
- Gold blocking.
- Hooking machines.
- Knot tying.
- Perforating and punching machines.
- Seam rubbing machines (Stanbon machine).
- Wax thread machines.

## Finishing department:

- Bench men (knifersup and takersoff).
- Bottom buffing.
- Edge trimming.
- Edge and waist setting.
- Heel scouring.
- Inking.
- Packing.
- Stitch separating.

## Heel making department:

- Heel building.
- Heel compressing.
- Rand packing.
- Tip nailing.

## Making department:

- Assembling.
- Automatic leveler operating.
- Bench men.
- Blake sewing.
- Breasting machine.
- Channel closing machine.
- Channel opening.
- Heel attaching machines.
- Hercules leveler.
- In seam trimmer.
- Lasting machines.
- Loose billing.
- Loose nailing.
- Nailing.
- Piece-sole attaching machine.
- Pounding-up machine.
- Pull-over machine.
- Rough rounding.
- Sole laying.
- Sole tacking.
- Standard screwing.
- Staple tacking.
- Stitching machine.
- Universal slugger.
- Upper trimming (Goodyear).
- Waste skiving.
- Welt beating.
- Welt sewing.

## Preparation department:

- Cementing machine.
- Feather-edge shank reducer.
- Fitting up.
- Gem canvas machine

*Boots and shoes*—Continued.

## Preparation department:

- Insole channeling.
- Julian or planet rounder.
- Nichols evener and grader.
- Outsole channeling.
- Piece sole beveling.
- Size stamping machine.
- Skiving machine.
- Sole molding.
- Stiffener molding.
- Rough stuff department:
- Cutting presses.
- Rolling.
- Rough stock keeping.
- Sorting.
- Splitting machines.

*Corsets.*

- Assembling parts.
- Cutting ends with heavy hand shears.
- Cutting (hand).
- Fitting.
- Folding cloth for cutting.
- Marking.
- Measuring.
- Overlooking.
- Packing.
- Platen printing.
- Pressing machine operating.
- Pressing with gas iron.
- Printing on bands.
- Rotary machine operating.

*Dress, mantle, and shirt making.*

## Dressmaking:

- Box making.
- Cutting and assisting in cutting room.
- Fitting up (wholesale).
- Laying out.
- Pressing.
- Stockkeeping.
- Traveling.
- Trimming.
- Warehouse work.
- Window dressing.

## Mantle making:

- Cutting fittings.
- Cutting linings.
- Cutting stiffenings.
- Ironing by hand.
- Pressing.

## Shirt making:

- Cutting and assisting in cutting room.
- Folding for cutter.
- Making up.
- Pressing.
- Stamping.
- Warehouse work.
- Washhouse work.

*Dyeing and cleaning, and laundering.*

## Dyeing and cleaning:

- Cleaning.
- Curtain folding and framing.
- Driving.

## CLOTHING TRADES—continued.

*Dyeing and cleaning, and laundering—*  
Continued.

Dyeing and cleaning:  
 Drying.  
 Dyeing and assisting in dyeing room.  
 Finishing.  
 Glazing.  
 Laundry work.  
 Packing.  
 Portering.  
 Sorting.  
 Stringing.  
 Tailor pressing.  
 Laundry work:  
 Curtain framing.  
 Mangling.  
 Washing.  
 Washing machines<sub>2</sub>(attending).

*Gloves.*

Fur cutting.  
 Glove cutting.  
 Leather dressing.  
 Scouring.  
 Supervising.

*Hats.*

Felt hats and caps:  
 Body making (hats).  
 Bright finishing.  
 Bronzing.  
 Cutting.  
 Examining bodies.  
 Forming.  
 Fur blowing.  
 Machine feeding.  
 Labeling.

*Hats—Continued.*

Felt hats and caps:  
 Packing.  
 Pasting.  
 Planking.  
 Pressing.  
 Printing.  
 Proofing.  
 Settling machines.  
 Shaving.  
 Sorting.  
 Steaming.  
 Washing after proofing.  
 Wiring.  
 Straw hats:  
 Cutting wheels.  
 Polishing.  
 Press blocking.

*Tailoring.*

Buttonholing.  
 Cutting and assisting in cutting room.  
 Examining.  
 Felling.  
 Folding.  
 Machining.  
 Making up.  
 Oiling.  
 Passing.  
 Pressing.  
 Putting trimmings ready for machinists.  
 Shrinking.  
 Sorting cut pieces.  
 Stock keeping.  
 Supervising.  
 Warehouse work.

## FOOD TRADES.

*Aerated waters, bottling.*

Bottle sorting.  
 Bottle washing.  
 Carrying crates.  
 Cleaning siphons.  
 Filling.  
 Fixing capsules.  
 Labeling.  
 Packing.  
 Polishing siphon tops.  
 Rerubbing stoppers.

*Bacon curing, margarine making, meat preserving, etc.*

Bacon curing:  
 Boning and rolling.  
 Packing.  
 Sewing up for army.  
 Soldering.  
 Stenciling.  
 Washing hams, bacon.  
 Margarine making:  
 Analysis of water, oil, and fats.  
 Lard compounding rollers (attending).  
 Packing.

*Meat preserving, meat pies, and sausage making.*

Bakery.  
 Boning meat.  
 Filling tins, pies, sausages, etc.  
 Jellying.  
 Lacquering.  
 Linking.  
 Packing.  
 Preparing skins.  
 Soldering.  
 Trucking.  
 Washing.

*Biscuit making.*

Bakehouse processes (except stoking).  
 Carrying trays from ovens.  
 Cutting.  
 Dough brakes (assisting at).  
 Feeding ovens.  
 Feeding traveling ovens.  
 Fruit cleaning machines (attending).  
 Labeling.  
 Nailing cases.  
 Operating lifts.  
 Operating weigh bridge.



## FOOD TRADES—continued.

*Biscuit making—Continued.*

Packing.  
Soldering.  
Salting biscuits.  
Stacking tins.  
Stenciling.  
Trucking and trolleying.  
Wafer machine (attending).  
Weighing.

*Bread, cake, and pastry making.*

Bread making:  
Baking.  
Carrying.  
Cleaning tins.  
Delivering (bread rounds).  
Greasing tins.  
Mixing.  
Molding.  
Packing.  
Washing.  
Weighing.

*Cake and pastry making:*

Baking cakes, confectionery, scones,  
and smalls.  
Boiling.  
Carrying.  
Decorating and finishing cakes and  
pastries.  
Icing.  
Mixing.  
Molding.  
Pastry making.  
Stamping.  
Weighing.

*Fruit preserving, chocolate, and sugar confectionery making.**Fruit preserving:*

Boiling.  
Bottle washing.  
Bottling.  
Filling.  
Lifting cans of sugar.  
Packing.  
Sterilizing.

*Chocolate and sugar confectionery making:*

Cake machine (feeding).  
Carrying.  
Confectionery center machine (at-  
tending).  
Cream-making machine (feeding).  
Filling chocolates.  
Kneading.

*Fruit preserving, chocolate, and sugar confectionery making—Continued.**Chocolate and sugar confectionery making:*

Molding and knocking cakes from  
mold.  
Molding chocolates.  
Packing.  
Starch hands.  
Sugar boiling.  
Transferring chocolate in grinding  
room.  
Trolley work.

*Grain milling.*

Bag cleaning.  
Branding.  
Brushing belts.  
Cardboard box making.  
Cleaning plant.  
Emptying into hoppers.  
Loading hoist (assisting in).  
Nailing up boxes.  
Packing.  
Picking.  
Portering.  
Riddling damaged bran.  
Sack cleaning.  
Sack filling.  
Sack mending.  
Stowing.  
Trucking.  
Warehouse work.  
Weighing.

*Sugar refining.*

Bag washing, mangling, drying, etc.  
Bag sewing.  
Box making.  
Box sewing.  
Cube cutting.  
Cutting machine binding.  
Filling bags, casks, and glucose molds.  
Filling treacle tins.  
Granulating.  
Light work on glucose manufacturing.  
Melting and mixing (assisting in).  
Mold and stove work (assisting in).  
Raw sugar centrifugals (attending).  
Refined sugar centrifugals (attending).  
Packing.  
Spreading sugar in boxes.  
Trucking.  
Weighing bags and casks.  
Unloading raw sugar.

## PAPER TRADES.

*Cardboard boxes.*

Binding.  
Calendar rolling (leather boards).  
Corner punching machine.  
Creasing machine (card boxes).  
Cutting machine (card boxes).  
Cutting card (fancy boxes).  
Damping.

*Cardboard boxes—Continued.*

Drying.  
Finishing.  
Gold blocking.  
Guillotine (feeding).  
Laying on.  
Nailing.  
Packing.

## PAPER TRADES—continued.

*Cardboard boxes—Continued.*

Paste filling.  
Platen-machine work.  
Plating.  
Printing.  
Punching.  
Rolling.  
Sandpapering.  
Scoring.  
Sheet laying.  
Stamping.  
Stock keeping.  
Stripping.  
Waste sorting.

*Paper and wall paper.*

Baling.  
Beaters and kneaders (feeding).  
Boatermen (assisting).  
Boilers (feeding esparto into).  
Bundling, tying into reams and half reams (generally up to about 40 pounds).  
Burnishing machine (attending).  
Calenders (assisting at).  
Chopper (feeding).  
Coating machine (assisting at).  
Coating silver paper.  
Collar gang.  
Collecting.  
Combing.  
Combing for paper coating.  
Cutting machines (filling; in some cases with aid of lifting tackle).  
Edge runners (feeding).  
Embossing.  
Enameling paper (feeding machine for).  
Esparto dusting and handling.  
Glazing.  
Grass breaking.  
Grinding machine (feeding).  
Guillotine (taking off).  
Hand crane (working).  
Kneaders and beaters (feeding).  
Laboring.  
Loading (vans, railway trucks, and steamers).  
Making up rolls.  
Melting rosin in pans.  
Mixing paper.  
Packing.  
Pattern department work.  
Potchers (feeding mechanical and chemical pulp into).  
Presse pate.  
Printing wall paper.  
Pulp bleaching.  
Pulping machines (feeding rags and paper clippings into).  
Reeling machines (assisting at certain kinds of).  
Roller-gang machine (feeding).  
Sampling.  
Sewing up bales.  
Sheet catching.

*Paper and wall paper—Continued.*

Sorting rags.  
Storing waste.  
Stowing bales of esparto and wood pulp.  
Taking from cutter.  
Trucking bales of wood pulp (up to 4 hundredweight).  
Trucking from esparto boilers.  
Twist catching at reeling machines.  
Tying and bundling into reams and half reams (generally up to about 40 pounds).  
Willowing machines (feeding esparto and mechanical pulp into).  
Varnishing.  
Warehouse work.

*Printing, bookbinding, stereotyping, engraving, etc.*

Binding.  
Blocking.  
Case making.  
Compositor's work (typesetting).  
Color printing (feeding and minding machines).  
Copy holding.  
Correcting type.  
Counting paper.  
Cutting paper.  
Cyko printing (photo enlarging).  
Distributing type.  
Eyeletting.  
Feeding printing machines (platens, Wharfedales, drum cylinders, two-revolutions, perfecting, two-color, etc.).  
Finishing (litho work).  
Finishing (photo enlarging).  
Machine minding.  
Monotype operating.  
Monotype keyboard work.  
Packing and tying up.  
Paper-bag folding, labeling, sticking down, etc.  
Picture post-card cutting and developing.  
Platen hands.  
Reading.  
Ruling machines.  
Storing pages of type.  
Type setting.  
Warehouse work.  
Wire stitching.

*Publication of newspapers and periodicals.*

Copy holding.  
Cutting for printer.  
Dispatch work.  
Folding.  
Letterpress machine work.  
Machine ruling.  
Numbering.  
Reading proofs.  
Stitching.  
Subediting.

## PAPER TRADES—continued.

*Stationery, pencils, gum, etc.*

Bending.  
 Binding.  
 Blocking.  
 Brass turning.  
 Coating.  
 Crate making.  
 Creasing.  
 Cutting.  
 Drilling.  
 Embossing.  
 Envelope adjusting, printing, stamping.  
 File making.  
 Mixing metal.  
 Gum mixing.

*Stationery, pencils, gum, etc.—Continued*

Label making.  
 Law writing.  
 Laying on.  
 Lead milling.  
 Machine ruling.  
 Packing.  
 Platen hands.  
 Printing.  
 Punching.  
 Ribbon making.  
 Reading.  
 Taking off.  
 Tube making.  
 Warehouse work.

## TEXTILE TRADES.

*Cotton.*

Spinning, doubling, etc.:  
 Balling warp.  
 Banding.  
 Blowing.  
 Bobbing in ring room.  
 Tan tenting.  
 Carding.  
 Condenser tenting.  
 Conditioning box feeding.  
 Creeling.  
 Cross-balling.  
 Derby doubler tenting.  
 Doffing.  
 Doubling.  
 Dye-house linking.  
 Dye-house unlinking.  
 Foreman (assisting).  
 Gassing.  
 Hand winding.  
 Hoist work.  
 Jobbing.  
 Knotting.  
 Making up.  
 Mixing and feeding machines.  
 Mixing and blowing room.  
 Moving cans in card room.  
 Oiling round mules and in ring room.  
 Opening bales.  
 Overlooking.  
 Packing cops in warehouse.  
 Papering bundles.  
 Piecing at mules.  
 Preparing waste.  
 Quilling.  
 Ring spinning.  
 Ring twisting.  
 Roving carriers.  
 Scavenging.  
 Scrutchers (assisting).  
 Shaking.  
 Slubber tenting.  
 Sorting bobbins.  
 Splitting.  
 Spreading.  
 Spinning-room work.

*Cotton—Continued.*

Spinning, doubling, etc.:  
 Stripping bobbins.  
 Tenting to Derby doublers on condensers.  
 Testing.  
 Ticketing.  
 Tidying and sweeping at cards.  
 Twisting.  
 Tubing.  
 Weaving:  
 Baling waste.  
 Beaming.  
 Bobbing carrying.  
 Braiding.  
 Card cutting.  
 Card tenting.  
 Cleaning waste.  
 Clipping.  
 Cloth looking.  
 Cut looking.  
 Drawers.  
 Drying waste.  
 Finishing (stitching).  
 Giving out weft.  
 Hand warping.  
 Loading waste.  
 Looming.  
 Plaiting.  
 Reaching in.  
 Roller covering.  
 Rolling.  
 Sett carrying.  
 Shearing.  
 Sorting and grading tares.  
 Sorting waste.  
 Trucking yarn.  
 Velvet cutting.  
 Warp making.  
 Waster breakers (assisting).  
 Weaving.  
 Weighing.  
 Willowing.  
 Winding.  
 Wrapping pieces.



## TEXTILE TRADES—continued.

*Hosiery.*

Boarding.  
 Carrying and packing.  
 Circular head machines.  
 Circular tenters.  
 Coton's frames.  
 Coton's machines.  
 Coton's frames (power).  
 Counterman.  
 Dolling.  
 Drying.  
 Dubred's flat machines.  
 Fettling.  
 Fettling and changing patterns.  
 Fine knitting machines.  
 Finishing.  
 Flat machines.  
 Folding.  
 Foster & Harrison's machines.  
 Hand frames.  
 Jersey heads.  
 Measuring.  
 Overlooking.  
 Pearl machines.  
 Pressing.  
 Scott-Williams's machines.  
 Supervising in various departments.  
 Trimming and overlooking.  
 Warehouse and inspecting.  
 Warehouse overlooking.  
 Warehouse work.  
 Warping for milanese fabric.  
 Winding.  
 XL machine.  
 Yarn men.

*Jute.*

Batching.  
 Calendering.  
 Cloth picking.  
 Cropping machine winding.  
 Dressing.  
 Hand-cutting bass.  
 Hydraulic press packing.  
 Machine feeding.  
 Packing.  
 Preparing.  
 Putting up yarn in dyehouse.  
 Rove frames (working on).  
 Sack bundling.  
 Sewing ends.  
 Shifting bobbins.  
 Spinning.  
 Stitching.  
 Tenting.  
 Twisting.  
 Weighing up cans.

*Lace.*

Beaming.  
 Brass winding.  
 Punching at cards.  
 Reading off.  
 Shuttlings.  
 Spooling.

*Lace—Continued.*

Stripping.  
 Threading.  
 Threading levers lace.  
 Warping

*Linen.*

Balling.  
 Beaming.  
 Bleaching cloth.  
 Breaker cans.  
 Brindling.  
 Card copying.  
 Carding.  
 Cropping machine winding.  
 Cutting.  
 Drawing.  
 Dressing.  
 Drying.  
 Examining.  
 Finishing cloth.  
 Finishing thread.  
 Hackling.  
 Hemp breaking.  
 Lapping machine winding.  
 Loom tenting.  
 Machine repairing.  
 Mounting.  
 Piecing.  
 Ruffing.  
 Roving.  
 Spinning.  
 Warehouse work.  
 Warping.  
 Weaving.  
 Yarn preparing machine minding.  
 Yarn weighing.

*Mat and fiber.*

Balling up.  
 Cleaning fiber.  
 Fiber mixing machines.  
 Hand finishing.  
 Hand hackling.  
 Hand loom weaving.  
 Large power loom weaving.  
 Pulling down yarn.  
 Quill (winding).  
 Rod mat weaving.  
 Stranding.  
 Winding.

*Rope and twine.*

Balling.  
 Doubling.  
 Fore board.  
 Knotting.  
 Machine minding.  
 Machine twisting.  
 Making twine.  
 Preparing.  
 Ropewalk stranding.  
 Small rope making machines.  
 Splicing.  
 Splicing, fixing pegs on ropes.  
 Stretching.

## TEXTILE TRADES—continued.

*Rope and twine—Continued.*

Stripping.  
 Making up and packing.  
 Supervising.  
 Tarring.  
 Winding.  
*Sack making.*  
 Beating.  
 Cleaning.  
 Cleaning at power-driven brushes.  
 Examining.  
 Hand cutting machine.  
 Hand stitching coal sacks.  
 Machine stitching nose bags.  
 Packing.  
 Power machining.  
 Receiving.  
 Repairing.  
 Sorting.  
 Stamping.  
 Trucking.  
 Twining.  
 Warehouse work.  
 Weighing.

*Silk.*

Bobbin carrying.  
 Braid tenting.  
 Combing.  
 Cutting.  
 Finishing.  
 Looming.  
 Reeling.  
 Spinning.  
 Supervising in spooling room.  
 Throwing.  
 Twisting.  
 Warehouse work.  
 Warping for Appold looms.  
 Weaving.  
 Winding.

*Textile small ware, tents, belting, braid, etc.*

Braiding rubber.  
 Brattice cloth machine minding.  
 Brass winding.  
 Carrying washed hair to kilns.  
 Cleaning cylinders.  
 Cording.  
 Cutting holdalls.  
 Cutting out tents.  
 Eyeletting.  
 Feeding machines (brattice cloth).  
 Feeding teasing machines (hair).  
 Garneting.  
 Grummeting.  
 Hammock sewing.  
 Inspecting.  
 Machining tents.  
 Mixing clay.  
 Rag washing.  
 Scribbling machines.  
 Sizing hemp spinners.  
 Splicing small cards.  
 Stitching tents.

*Textile, small ware, tents, belting, braid, etc.—Continued.*

Strap sewing.  
 Stripping.  
 Tarpaulin spinning.  
 Tent finishing.  
 Threading.  
 Warping belting.  
 Weaving horsehair cloth.  
 Weaving small wares.

*Textile bleaching and dyeing yarns.*

Bundle dyeing:  
 Banding and assisting in grey room.  
 Heading (in dry process).  
 Making up and pressing (on power presses).  
 Papering and ticketing.

*Cops:*

Packing cops in cases after drying.  
 Packing in dyeing machines.  
 Spindling.  
 Stoving.

*Raw cotton dyeing:*

Feeding cotton breaker (preparatory to drying after dyeing).

*Warps:*

Assisting in grey room.  
 Balling machines, up to warps of 25 pounds each.  
 Box watching of dyeing machines and in some cases size machine.  
 Warp splitting (either by hand or power).

*Piece goods—bleaching:*

Assistants on tins—  
 Guiding in on slip stretchers, belt stretchers, and stenter.  
 Marking lot numbers in grey room.  
 Piling light goods.  
 Scutching.  
 Stitching.

*Making up room—*

Assisting in carrying off for stampers.  
 Assisting in filling and emptying hydraulic press with light goods (not lifting iron plates).  
 Banding.  
 Creasing.  
 Cutting.  
 Cutting patterns.  
 Light stamping.  
 Making up light goods.  
 Making up light shirtings.  
 Parceling light goods.  
 Parceling light shirtings.  
 Paring.  
 Piling light goods ready for press.  
 Plaiting.  
 Ribboning.  
 Silking.  
 Straightening.

## TEXTILE TRADES—continued.

*Textile bleaching and dyeing yarns*—Continued.

## Piece goods—bleaching:

## Making up room—

Taking light goods out of presses (not lifting pieces).

Taping.

Ticketing.

## Packing room—

Marking off.

Marking out pack tickets and invoices.

Taking lengths.

*Calico printing.*

Bleach croft:

Plaiting down.

## Dyeing and soaping departments:

Guiding pieces.

Plaiting down from drying machines.

Sewing.

## Finishing:

Guiding pieces.

Sewing.

Taking off drying machines.

## Grey room:

Sewing.

Stamping.

## Machine room:

Plaiting down for printing machines (provided the heat is not excessive).

## White room:

Drying tins.

## Stamping and sewing (not carrying).

## Stentering:

Feeding and plaiting down (provided the heat is not excessive).

Sewing.

## Warehouse:

Clerical work.

Cutting and straightening.

Pattern cutting.

Plaiting machines.

Silking.

*Dyeing (velvet and cords).*

Ageing, loading, and unloading.

Bleaching ash pans, sour kettles, chemic machines, washing machines, minces, mangle, etc.

Card cutting by hand and machines on velvet goods only.

## Doctoring.

Drying cylinders: Edge minding, tail-ending, wiring in, and carrying.

## Examining cloth.

## Finished goods room:

Charge of mender room.

Checking goods for town.

Stamping.

## Finishing machines.

Gregging room.

Grey treadles, etc.

*Dyeing (velvet and cords)*—Continued.

Grey stock rooms (receiving, wheeling trucks, etc.).

Laboratory (assistants).

Mole department (backing, shearing, finishing).

Passing table (marking off, carrying, etc.).

Peg machines (minders, pulling over, and carrying).

Piece carrying, trucking, etc.

Grey departments.

Plaiting machines.

Pony driver.

Scouring winces (first time and picker).

Setters up.

Shearing machines.

Soaking becks.

Stretching.

Tramway attendants.

Washing and brushing.

Whizzing (first time pickers and dyed).

*Dyeing, other than velvet and cords.*

## Cloth overlooking:

Stiffening and drying on continuous machines; guiding in or taking off.

## Finishing:

Back of Schreiner calenders; guiding on batch at back.

Damping machines; guiding on from wagons and plaiting off.

Holding through endless.

## Making-up room—

Banding, taping, silking, and ribboning.

Cutting and straightening.

Cutting patterns.

Filling and emptying press (plates must not be lifted by women).

Light hooking and stamping.

Light parceling, making up light goods.

Marking off and picketing.

Papering and tilloting.

Plaiting and creasing machines.

Pin and clip stretching; guiding in and plaiting off.

## Storekeeping.

Strap stretching; guiding in and plaiting off.

Grey room: Sewing, measuring, weighing, stamping, and piling light work.

Hot-air stenter: Guiding in and taking off, weft, straightening.

Mercerizing: Assisting at mercerizing machines; guiding and plaiting off.

Raising and felting machines.

Scutching: Open onto wagons.

Sewing: In any part of the works.

N. B.—Batch carrying and lifting must be done by men.



## TEXTILE TRADES—continued.

*Webbing.*

Band knife cutting.  
 Cloth shrinking.  
 Cutting.  
 Eyeletting.  
 Finishing.  
 Fitting ends to straps.  
 Riveting to wood battens for shell slings.  
 Stitching.  
 Stretching.  
 Stringing.  
 Taking off calenders.  
 Taking off dyehouse machines.  
 Washing pieces on winces.  
 Washing machines.  
 Waxing.  
 Working hydro extractor.

*Woolen and worsted.*

Woolen:  
 Banking and bolting.  
 Blanket folding, beaning, raising, stacking.  
 Blending.  
 Blowing.  
 Burling.  
 Carding.  
 Condenser watcher.  
 Creeling.  
 Cutting and cropping.  
 Drawing.  
 Dyeing.  
 Examining.  
 Feeding rag shaker.  
 Filling patent automatic hopper feeds.  
 Filling quilts.  
 Hoist work.  
 Knotting.  
 Laying-on departments.  
 Machine tenting.  
 Milling department.  
 Mending machines in finishing department.  
 Minding scrubber machines.  
 Mule spinning.  
 Packing.  
 Perching.  
 Pattern weaving.  
 Piece inspecting.

*Woolen and worsted—Continued.*

## Woolen:

Piecing.  
 Pressing.  
 Rag grinding.  
 Raising.  
 Reaching in.  
 Reeling.  
 Ring spinning.  
 Scouring.  
 Sorting.  
 Stock keeping and handing out yarns.  
 Taking bobbins from condenser.  
 Twisting in.  
 Warehouse work.  
 Warping.  
 Warp sizing.  
 Watching wool at scribbler ends.  
 Weaving.  
 Winding.  
 Yarn dyeing machines.

## Worsted:

Back washing machine minding.  
 Bobbin carrying.  
 Breaking off.  
 Can catching.  
 Card end minding.  
 Card feeding.  
 Card picking.  
 Carding machine minding.  
 Combing machine minding.  
 Doffers' assistant overlooker.  
 Gilling machine minding.  
 Hanking.  
 Loosing after combs.  
 Papering yarns.  
 Perching.  
 Preparing box minding.  
 Set weighing.  
 Twisting in.  
 Warping.  
 Washbowl.  
 Weaving.  
 Weft-room work.  
 Wetting.  
 Willeying machine minding.  
 Yarn drying.  
 Yarn testing.

## WOODWORKING TRADES.

*Box and packing case making.*

Backing up.  
 Barrel making.  
 Boring.  
 Box corner planing.  
 Box making.  
 Branding.  
 Buffing.  
 Carrying boxes.  
 Checking.  
 Circular saws (small), feeding and taking off.

*Box and packing case making—Continued.*

Compressing.  
 Corner hinging.  
 Dovetailing.  
 Drawing from saws.  
 Drilling.  
 Feeding box making.  
 Finishing.  
 Fitting posts, pegs, and chairs.  
 General transport.  
 Gluing boards.  
 Grooving.

## WOODWORKING TRADES—continued.

*Box and packing case making—Continued.*

Handholeing.  
 Handle finishing.  
 Jointing.  
 Knotting handles.  
 Labeling wooden pegs.  
 Laboring.  
 Loading staves on trucks.  
 Machine drilling.  
 Machine minding.  
 Making up.  
 Matching.  
 Measuring staves.  
 Nail straightening.  
 Nailing.  
 Packing.  
 Painting.  
 Piling staves and heads.  
 Planing.  
 Printing.  
 Putting together.  
 Rope knotting.  
 Sandpapering.  
 Screwing.  
 Small turning.  
 Splicing handles.  
 Stacking boxes.  
 Tacking.  
 Tongueing.  
 Turning bobbins.  
 Turning tool handles.

*Furniture.*

Boring.  
 Buttoning cushions and mattresses.  
 Carving (hand and machine, etc.).  
 Cording.  
 Cover making.  
 Cramping.  
 Doweling.  
 Drawing cushions and mattresses.  
 Enameling.  
 Finishing (upholstery), etc.  
 Filling cushions and mattresses.

*Furniture—Continued.*

Fixing webs and springs.  
 French polishing.  
 Gluing.  
 Inlaying.  
 Molding.  
 Painting.  
 Repetition machine work, light, as under box and packing case making, above.  
 Sandpapering.  
 Seating throughout pin-stuffed chair.  
 Sewing.  
 Staining.  
 Tracing.  
 Turning.

*Sawmilling.*

Bench saws.  
 Boring.  
 Carrying timber.  
 Circular saws (small), feeding and taking off, etc.  
 Cork sizing.  
 Crosscutting.  
 Dovetailing.  
 Glue department.  
 Hole boring machine.  
 Laboring.  
 Lathe work.  
 Loading boards.  
 Loading pit props.  
 Making rifle holders.  
 Mortising.  
 Molding machines, feeding and taking off.  
 Nailing blocks together.  
 Papering boards.  
 Paving blocks.  
 Planing machines, feeding and taking off.  
 Tenoning.  
 Vertical spindle (straight work).

## MANUFACTURES.

*Basket making and wicker work.*

Basket fitting.  
 Basket making (lighter branches).  
 Cane work.  
 Lining panniers.  
 Packing.  
 Painting.  
 Peeling.  
 Sorting willows.  
 Wood cutting.

*Bricks.*

Common bricks:  
 Loading.  
 Pressing.  
 Setting.  
 Stacking.  
 Taking off from presses.  
 Wheeling.

*Bricks—Continued.*

Glazed and enameled bricks:  
 Cutting clay.  
 Dipping.  
 Drawing.  
 Enameling.  
 Finishing.  
 Glazing.  
 Molding.  
 Pressing.  
 Putting on slips.  
 Setting.  
 Taking off from presses.  
 Wheeling.

*Brush making.*

Boring by machine.  
 Drawing.  
 Dressing, fiber and bristle.

## MANUFACTURES—continued.

*Brush making—Continued.*

Drilling.  
Fashioning (2d fashioning) of bone brushes.  
Filling.  
Finishing.  
Gluing.  
Hair dressing.  
Hair mixing.  
Tacking.  
Paint-brush making.  
Painting.  
Pan work (fiber and hair).  
Passing.  
Planing.  
Polishing.  
Sandpapering.  
Shaping.  
Tacking.  
Trimming.  
Varnishing.  
Wood turning.

*China, earthenware, and pottery china.*

Board washing.  
Casting.  
Cleaning stoves.  
Cleaning mangles.  
Coloring machine attending.  
Decorating.  
Dipping.  
Dusting.  
Dusting off machines.  
Filling Saggers with ware (both glost and biscuit).  
Flat jolleying.  
Flat knocking.  
Hand coloring.  
Handling.  
Hollow-ware jiggering.  
Hollow-ware jolleying.  
Litho-transfer making (various subsidiary processes).  
Mold running.  
Placing (not heavy carrying).  
Tile pressing.  
Turning.

*Fire-clay goods.*

Application of bodies and glazes.  
Carrying pipes (small sizes).  
Fettling.  
Finishing.  
Laying out tiles.  
Making tiles by hand.  
Making small sinks, basins, etc.  
Setting.  
Stacking up.  
Taking off fire bricks from presses.  
Wheeling kiln.

*Stoneware.*

Dipping jam jars and stone bottles.  
Making jam jars and stone bottles.  
Packing jam jars.  
Turning jam jars.

*Ware, red and buff clay.**Glazed:*

Clay preparing.  
Drawing.  
Glazing.  
Setting.

Taking off from thrower.

*Unglazed (flower pots, tiles, etc.):*

Carrying to kiln.  
Drawing.  
Taking from presses to machines.  
Throwing flower pots.  
Wheeling.  
Tobacco pipes, molding.

*Games, toys, etc.*

Crosscut and circular saws.  
Cutting out (football covers).  
Lathe work.  
Leather work.  
Machine work.  
Packing.  
Painting.  
Picture frame joining.  
Polishing.  
Power presses.

*Glass.**Glass bottle making:*

Carrying from blowers to oven.  
Carrying from tables.  
Emptying and filling lehrs.  
Packing.  
Puntying bottles.  
Riddling.  
Sorting bottles.  
Trucking.

*Other glass making:*

Bending.  
Box making.  
Carrying plate glass.  
Cementing leaded panes.  
Cleaning glass.  
Crane driving.  
Discharging.  
Glass cutting.  
Glass edging.  
Glass grinding.  
Making iron hampers.  
Mixing (assisting).  
Packing.  
Polishing.  
Silvering.  
Syringe work.  
Working broken glass.

*India rubber and gutta-percha.**Manufacture and reclaiming of rubber:*

Calenders (assisting).  
Chemists' department (assisting).  
Crushing on the masticators.  
Drying cylinders (assisting).  
Feeding calenders.  
Mixing machine minding (dry powders).



*India rubber and gutta-percha—Continued.*

Mixing machine minders (wet preparatory to spreading).  
 Rough spreading.  
 Packing, etc., in stores.  
 Taking off strip rubber from calendars.  
 Warming up.  
 Washing on the masticators.  
 Manufacture of rubber articles:  
 Armouring machine (hose of small diameter).  
 Asbestos cloth cutting.  
 Blowing on and off cycle tubes.  
 Buffing.  
 Building up of treads.  
 Building up of tires.  
 Case making.  
 Cleaning tires.  
 Cold cure department.  
 Corrugating vacuum hose.  
 Covering bands.  
 Covering wringer rollers.  
 Cutting and making up joints, valves, washers, etc.  
 Cutting and making up cushions, hot water bottles, water beds, etc.  
 Cutting and making up rubber gloves.  
 Cutting canvas.  
 Cutting ground sheets and garments by cutting machines, short knife and slot knife.  
 Cutting rubber for tires, etc.  
 Cutting.  
 Cycle tube making.  
 Fixing thread.  
 Hose-making assistants (large diameter hoses).  
 Hose making, machine and hand (small diameter hoses).  
 Hydraulic press attending.  
 Making up joints, valves, washers, etc.  
 Measuring.  
 Molding (hydraulic presses and helping at steam vulcanizers).  
 Fasting up of cloth.  
 Riveting steel studs.  
 Rubbering bands.  
 Sieving cushions, hot-water bottles, and water beds, etc.  
 Short knife cutting.  
 Slot knife cutting.  
 Spreading department, pasting up.  
 Steam vulcanizers (helping at light work).  
 Steel stud riveting.  
 Solid tire department.  
 Covering and rubbering bands.  
 Tube making by hand.  
 Tubing machines.  
 Tire cleaning.

*India rubber and gutta-percha—Continued.*

Manufacture of rubber articles:  
 Tire examining.  
 Vacuum hose making up (by hand).  
 Varnishing.  
 Vulcanite buffing.  
 Warehouse processes.  
*Leather dressing and tanning.*  
 Blue striking out.  
 Brushing off.  
 Brushing on.  
 Buffing.  
 Carrying off from machines.  
 Carrying off from sorters.  
 Coloring.  
 Carrying.  
 Dipping in hypo and acid liquors.  
 Embossing.  
 Emptying barrels.  
 Emptying tumblers.  
 Glazing machines (slow action).  
 Hair sorting and dyeing.  
 Handling at lime pits.  
 Handling at slings or pits.  
 Hanging leather.  
 Hooking light leather from pits.  
 Horsing-up.  
 Ironing.  
 Light laboring.  
 Liquor pumps, (attending).  
 Offal parts (all processes).  
 Oiling.  
 Opening out skins.  
 Paddles (attending).  
 Piling skins on horses.  
 Pinner machines (assisting).  
 Polishing.  
 Printing.  
 Rolling.  
 Scouring.  
 Scraping off hair which machines have failed to remove.  
 Seasoning.  
 Serial striking out.  
 Setting machines (attending).  
 Single striking-out.  
 Sizing.  
 Softening.  
 Sorting hair and leather.  
 Splitting.  
 Staining.  
 Staking.  
 Storing in racks.  
 Straining (handwork).  
 Stuffing.  
 Vat (attending).  
 Washing.  
*Leather goods.*  
 Cutting.  
 Dressing.  
 Machining.  
 Finishing.  
 Nailing.

## MANUFACTURES—continued.

*Leather goods—Continued.*

Packing.  
 Passing.  
 Pasting.  
 Press working.  
 Punching-out.  
 Riveting.  
 Sewing.  
 Stamping.  
 Stitching.  
 Sorting.  
 Varnishing.  
 Vise working.

*Linoleum, celluloid, horn, etc.*

Linoleum and floor cloth:  
 Block building.  
 Color mixing.  
 Cork grinding.  
 Cork trimming.  
 Felt rolling.  
 Finishing.  
 Inlaid making.  
 Laying.  
 Packing.  
 Stove work (filling and emptying).  
 Trimming.  
 Varnishing.  
 Celluloid and horn:  
 Butting.  
 Button turning.  
 Dollifying.  
 Drawing.  
 Grinding.  
 Polishing.  
 Setting.

*Pianos and other musical instruments.*

Pianos:  
 Actions—  
 Broaching.  
 Bushing.  
 Centering.  
 Checking.  
 Covering.  
 Drilling.  
 Finishing.  
 Regulating.  
 Screwing down.  
 Slotting.  
 Wire buttoning.  
 Wiring.  
 Case making—  
 Filling.  
 Finishing and regulating.  
 Fly finishing.  
 Staining.  
 Varnishing and polishing.  
 Varnishing sounding boards.  
 Veneer cutting.  
 Veneer laying.  
 Veneer trimming.  
 Hammers—  
 Cleaning.

*Pianos and other musical instruments—Continued.*

Pianos:  
 Hammers—  
 Felting.  
 Making.  
 Shanking.  
 Stitching.  
 Keys and keyboards—  
 Boring.  
 Cutting.  
 Finishing.  
 Saw milling.  
 Metal stud making wrest pins—  
 Cutting machines.  
 Drilling machines.  
 Filing machines.  
 Hammering machines.  
 Other musical instruments:  
 Assembling.  
 Cleaning.  
 Light machine work.  
 Packing.  
 Player work.  
 Sandpapering.  
 Storeroom work.  
 Varnishing.  
 Woodworking machines.

*Tobacco.*

Basket wheeling.  
 Blending.  
 Cardboard box making.  
 Cigar making.  
 Cigarette machines.  
 Cigarette collecting.  
 Cutting machines.  
 Helping stovers.  
 Hydraulic club pressing.  
 Inspecting.  
 Knocking off colors.  
 Labeling.  
 Leaf handling.  
 Leaf stripping.  
 Liquoring.  
 Machine dressing.  
 Marking and hooking.  
 Packing.  
 Packing presses.  
 Plugging machine feeding.  
 Printing.  
 Proctor machines.  
 Roll making.  
 Rotary machines.  
 Shag spreading.  
 Sorting in warehouse.  
 Spinning.  
 Stove soldering.  
 Supervising.  
 Sweeping.  
 Tobacco cutting.  
 Tray carrying.  
 Wetting machine.

## NONINDUSTRIAL OCCUPATIONS.

*Clerical work.*

Women are now employed in all kinds of clerical work in banks, business houses, government, insurance, municipal, professional, and railway offices.

*Porterage and light laboring.*

Women are being employed upon carrying and light laboring work in most trades. They are fitted for all such work except where heavy lifting or pushing is required. In some cases the introduction of mechanical devices has brought work otherwise too heavy within their powers.

*Post-office work.*

Women have long been employed on post-office work, both clerical and manipulative, and are now employed on many duties hitherto performed mainly or exclusively by men. For example, several thousand women are now engaged in three shifts covering the 24 hours in sorting letters and parcels at the inland circulation office at Mount Pleasant. Others are engaged in sorting work for the Army post-office and some even in the traveling post offices. Large numbers are employed as postmen, both in town and country.

They are also employed in clerical duties (headquarter or administrative offices); counter duties (sale of stamps, licences, etc., issue and payment of postal and money orders, and savings bank, parcels post, and telegraph business); manipulative duties, indoor (telegraphy, telephone exchange work, trunk telephone work, sorting letter mail, bag opening, etc., sorting of newspapers and of parcel mails); outdoor (postmen's work—i. e., collection and delivery of letters or parcels on foot or on cycle—both in town and rural areas); and traveling post-office work (sorting in the post-office mail vans attached to the chief mail trains).

*Retail and distributive trades.*

Women are being extensively employed by retail tradesmen for counter work, packing, and delivering in trades where men were previously employed. Packing and delivering are considered under warehouse work and van work (transport) respectively. The employment of women on counter work depends to some extent on the weight of the goods to be handled. In some trades, e. g., grocery, the goods may be packed in smaller quantities than was formerly usual, while in others a few men must be retained for heavy lifting. Even in the latter case, however, there is often much work which can be done by women. In the piece-goods department of a large draper, for instance, women may not be able to lift the heavy rolls of cloth, but all the actual serving, measuring, etc., may be done by them and the male staff thus greatly reduced.

*Transport trades.**Railways:*

- Booking clerks.
- Carriage cleaners.
- Carriage washers.
- Carriage repairs (seats, upholstery).
- Clerks (administrative offices).
- Cooks in dining cars.
- Electric-train cleaners.
- Engine cleaners and greasers.
- Goods porters (barrowing, etc.) in goods yards or warehouses.
- Laborers in repair sheds.
- Lift attendants.
- Laborers in stations, (trucking, etc.).
- Machinists in railway workshops.
- Messengers.
- Number takers.
- Parcels porters.
- Platform porters.
- Telegraphists.
- Ticket collectors.
- Ticket inspectors.



## NONINDUSTRIAL OCCUPATIONS—continued.

*Transport trades—Continued.**Railways:*

Waitresses in hotels, refreshment rooms, and dining cars.

Wagon sheet repairers.

*Tram and omnibus services:*

Chauffeuses.

Cleaners in electric power stations.

Magnet and coil winders.

Switchboard attendants in electric power stations.

Tram and omnibus cleaners.

Tram and omnibus conductors.

Tram and omnibus drivers.

Tram and omnibus inspectors.

*Van work, delivery, etc.*

Women are now employed to drive motor and horse vans and to deliver for business houses of all kinds and more especially for retail traders.

*Warehouse and stores work.*

Women are now employed for packing, loading, barrowing, and other warehouse work in the post-office stores, railway stores, railway goods stations, and warehouses, and business houses. The only work of this kind which they can not undertake is that which involves heavy lifting.

In some cases, e. g., "Manchester" warehouses, much of the heavy lifting must be done by men, though by rearrangement of work their labor may often be "diluted" by that of women. In other types of business, e. g., grocery trade, flour milling, etc., the goods can be handled by women if packed in smaller quantities than formerly.

*Gas and electricity supply.*

Barrowing coke.

Cleaning and maintaining lamps, burners, and mantles.

Collecting accounts.

Fitting stoves.

Inspecting meters.

Laboring (lighter work).

Lighting street lamps.

Loading coke or breeze.

Packing coke or breeze.

Reading meters.

Screening coke or breeze.

Show-room attendants.

Show-room cleaners.

Switchboard attendants.

Testing meters.

Washing coke or breeze.

## MUNITIONS WORK.

Successfully undertaken by women in temporary substitution for male labor.

## I. List of chief trades represented.

Aeroplane manufacture.

Ammunition manufacture.

Artillery manufacture.

Brick making.

Canvas goods manufacture.

Chemical trades (explosives).

Electrical trades (including telephone, telegraph, and wireless).

Engineering generally.

Explosives manufacture.

Instrument making, optical and scientific.

Leather and canvas goods manufacture.

Marine engineering.

## MUNITIONS WORK—continued.

I. List of chief trades represented—*Continued*.

Mechanical engineering.  
 Metal trades.  
 Optical instrument making.  
 Rubber manufacture.  
 Scientific instrument making.  
 Shipbuilding.  
 Soap manufacture.  
 Woodworking.

## II. Summary of processes.

Acetylene welding, aero engine parts, brass tubes of 18 gauge, etc.  
 Angle irons.  
 Smith's work (as helpers and back-handers)—shipbuilding.  
 Armature winding, small coils.  
 Assembling aero bomb droppers, cages for ball bearings, countershafts, electric fittings, motors (small), switches, fuse adapters, gear parts, etc.  
 Banding, pressing, and turning copper bands on shells.  
 Beading sheet metals, etc.  
 Bench work (fitting), assembling, filing, fitting, marking off, scraping.  
 Bending aero engine parts, pressure-gauge tubes, etc.  
 Blading, turbine rotors, stators, threading blades.  
 Blending explosives.  
 Blocking, mirrors (prisms, optical munitions).  
 Boiling cotton for explosives.  
 Bolt making on automatic machines.  
 Boring castings, forgings, howitzer bombs.  
 Lathe spindles, turbine segments, wheel blanks, etc.  
 Braiding wire.  
 Branding files.  
 Brass castings.  
 Brass finishing.  
 Braziers' work, as plumbers' and coppersmiths' helpers.  
 Brazing turbine blades.  
 Briquette making, coal (small).  
 Broaching to limit of 0.0005.  
 Bronzing parts of electrical apparatus and scientific instruments.  
 Buffing (metal) cartridge cases.  
 Buffing (rubber) vulcanized rubber sword handles, etc.  
 Cable covering and insulating—electric, telegraph and telephone.  
 Casing rubber tires.  
 Casting brass (foundry work).  
 Casting shrapnel, bullets, etc.  
 Calking turbine segments, etc.  
 Cementing lenses (optical munitions).  
 Centering lenses (optical munitions).  
 Chamfering lenses (optical munitions).  
 Chamfering woodwork, ammunition boxes.  
 Charging nitric acid retorts (explosives).  
 Classifying bolts (shipbuilding).  
 Coiling steel strips for cartridges, wire (electric).  
 Coloring patterns, wood.  
 Core making (foundry), brass, copper, iron.  
 Countersinking holes in ships' plates, etc.  
 Crane driving, electric overhead traveling cranes.  
 Crucible making, clay, for foundries.  
 Cutting carbons (electric) to length; condenser tubes; files (by hand and by machine); flue holes in boiler end plates, gears, bevel, helical, and spur; keyways (on slotting machines); machine tools; turbine segments; wire for darts; etc.  
 Cutting, oxy-acetylene process.  
 Dial writing, boiler and engine fittings, pressure gauges, etc.  
 Dipping (nitrating) cotton for explosives.  
 Dipping (plating) electric apparatus, etc.

## MUNITIONS WORK—continued.

II. Summary of processes—*Continued.*

Dividing clinometers, compass dials, etc.  
 Doping aero wing covers.  
 Dovetailing woodwork, ammunition boxes, etc.  
 Drawing wire.  
 Dressing castings (foundry work).  
 Drilling aero parts, bearings, boiler end plates, boiler flues, boiler shells, bombs, (howitzer), (cast-iron), breech mechanisms, clocks for scientific instruments, horseshoes, turbine segments, etc.  
 Drilling multiple spindle machines.  
 Drilling slot drilling (slotting machines).  
 Drying cotton (raw or nitrated) for explosives, etc.  
 Dry soap making.  
 Edging glass (lenses), sheet metal.  
 Enameling parts (electrical apparatus, instruments, etc.).  
 Engraving dials (boiler and engine fittings, pressure gauges, scientific instruments, etc.).  
 Explosives (processes generally), blending cubes, boiling cotton, centrifuging, charging retorts, cutting sheets into cubes, dipping, drying, firing retorts, grinding, incorporating, mixing, nitration, pressing, reeling cordite, rolling paste into sheets, sifting, sulphurating, etc.  
 Facing bolt holes, nuts, pipe flanges, etc.  
 Ferruling condensers and oil coolers.  
 Fettling bearings, small parts, etc.  
 Filing, aero engine parts, aluminum packing for rotors (turbine) armature cores, brass wedges for rotors (turbine), gear parts, wheel blanks for hardening, etc.  
 Filling ammunition bombs (explosive), gas or smoke, cartridges, shells, (H. E. shrapnel, or star), and explosives generally.  
 Filling in and marking indicator plates with wax, wood patterns, etc.  
 Firing nitric acid retorts, (explosives).  
 Fitting (bench work), aero bomb droppers, clips, countershafts, machine gun parts, slide rests, etc.  
 Flaking picric acid (explosives).  
 Flanging pipes, sheet-metal, tin work, etc.  
 Flatting motor cycle parts.  
 Fluting aero engine parts, taps, etc.  
 Folding sheet-metal.  
 Foundry work (brass, copper, iron), clay work (crucibles), core making, dressing castings, molding, tub work.  
 French polishing.  
 Galleting ore (putting up in pans briquettes).  
 Galvanizing small parts, etc.  
 Gauging fuses, schrapnel bullets, small parts, etc.  
 Gluing wood work, ammunition boxes, etc.  
 Grinding ball races, bearings, files, glass (for engine fittings, pressure gauges, optical instruments), liners, machine tools, (milling cutters, twist drills, valve seating cutters), nuts (faces of lock nuts), tools (saws, small tools, etc.).  
 Grinding (interior) friction rings.  
 Grinding (to size) to one-quarter thousandths of inch pins for registering lathe turrets.  
 Grinding and mixing explosives.  
 Guillotining sheet metals, tin works, etc.  
 Hammer driving, power.  
 Hand stitching canvas haversacks.  
 Hardening saws, etc.  
 Heating rivets (shipbuilding).  
 Heat testing explosives.  
 Holders-up, shipwork.  
 Incorporating and mixing explosives.  
 Inspecting (generally) parts and finished articles.  
 Insulating cable (by machine).  
 Japanning tin work.  
 Jointing, making metal joints, soldering, welding, etc.



## MUNITIONS WORK—continued.

II. Summary of processes—*Continued.*

Jointing, making rubber joints for ships' pipes.  
 Jogging, assisting at hogging machine on small plates (shipbuilding).  
 Laboring work, bagging slag, barrowing, carrying, cleaning (shops and machinery), clearing up, red leading, clipping, (shipyards) cutting soap, driving horses, loading, packing, shoveling (cinders, coke, loam, etc.), sorting (scrap, etc.), stable work, teaming horses, trucking, washing (carboys, etc.), wheeling, weighing, etc.  
 Lacquering brass parts, fuses, radiator tubes, scientific instruments, etc.  
 Machine tool making, various automatic and semiautomatic processes (boring, cutting, drilling, milling, slotting, turning, assembling, fitting, etc.).  
 Machining (engineering) generally.  
 Machining (sewing) aero wing covers, canvas, leather equipment, etc.  
 Marine engineering, various processes.  
 Marking dials and gauges (pressure, etc.) on card or metal.  
 Marking off bench work, fitting.  
 Marking out casting, etc., on surface table.  
 Micrometer work.  
 Milling, cross, slot, spiral, and vertical.  
 Milling aero engine parts, cutters (teeth in), machine guns (cross milling), square turrets for lathes, caps, turbine blades, segments, etc.  
 Mixing explosives.  
 Molding metal, foundry work, shrapnel bullets.  
 Molding, rubber.  
 Nickeling parts.  
 Nitrating (dipping) explosives.  
 Operating machines, automatic machines, band saws, bolt centering machines, table insulating machines, cranes (electric, overhead, traveling), dovetailing machines, drills (multiple, spindle, sensitive), engraving machines, grinding machines (Churchill cylindrical grinder), jogging machine (shipbuilding), lathes (capstan, center, chuck, turret, etc.), milling machines (cross, slotting, spiral, vertical), reamering machines (special), screwing machines, studding machines, tapping machines, etc.  
 Oxy-acetylene cutting and welding.  
 Oxydizing.  
 Packing generally.  
 Painting generally.  
 Papering ammunition boxes, dynamometer bars, etc.  
 Pelleting picric acid (explosives).  
 Photography, photo plan work.  
 Picking cotton for explosives.  
 Planing (machine), general light work, plate edges (ships' plates).  
 Plate bending (machine), ships' plates.  
 Plating as platers' helpers (shipbuilding).  
 Plating (electro plating), electric apparatus, fuses, instruments, etc.  
 Polishing (glass) lenses, optical munitions.  
 Polishing (metal) electric apparatus, fuses, instruments, etc.  
 Polishing (wood).  
 Pressing (metal) seams (tin work), sheet metal, shrapnel bullets.  
 Pressing explosives.  
 Press stamping, brass, tin work, etc.  
 Profiling machine guns.  
 Pulping cotton for explosives.  
 Red leading.  
 Reamering (special machine).  
 Recessing ends of Lincoln pins (chains).  
 Reforming cartridge cases.  
 Riveting base plugs for shrapnel, boiler flues (operating portable hydraulic riveter).  
 Rolling carbons (electric), sheet metal.  
 Rolling out dents in cartridge cases.  
 Rope making, hemp core for wire rope, wire rope.  
 Roughening lenses (optical munitions).  
 Rubber work, electric cable covering and insulating; tires, casing; sword handles (vulcanized rubber), buffing, rubbing, shellacking, polishing, solution work on aero plane wings.

## MUNITIONS WORK—continued.

II. Summary of processes—*Continued.*

Sand blasting (cleaning) motor-cycle parts.  
 Sandpapering wooden patterns, etc.  
 Scoring brass parts for pressure gauges, etc.  
 Scouring for electro-plating.  
 Scraping (bench work) gear castings, slide rests, etc.  
 Scraping (for enameling) motor parts, etc.  
 Screw cutting parallel threads to limits.  
 Screwing (machine) pipes, etc.  
 Screwing (wood) aeroplane parts, woodwork, generally.  
 Seaming sheet metal.  
 Shank lenses (optical munitions).  
 Shaping carbons (electric).  
 Shaping metals, gear parts, pressure gauges, etc.  
 Shellacking vulcanized rubber sword handles.  
 Sharpening band saws, saws, taps, etc.  
 Sherardizing.  
 Shipbuilding, various machining processes and laborer's work.  
 Sifting explosives.  
 Silvering mirrors (optical munitions).  
 Sizing aero wing.  
 Sizing cartridge cases, fuses, etc.  
 Slitting glass (optical munitions).  
 Slot drilling, general.  
 Slot milling, general.  
 Small tool making, various automatic and semiautomatic processes, grinding, sharpening, etc.  
 Smoothing (glass) lenses.  
 Smoothing (wood) dynamometer bars, etc.  
 Softening cartridge cases.  
 Soldering, plumbers' or coppersmiths' laborers.  
 Soldering acetylene lamps, fuse boxes (tin), respirators, etc.  
 Solution work on aero-wing covers.  
 Sorting balls (for bearings), bolts, rivets, rollers (for bearings).  
 Spinning tin work.  
 Splicing (wire), assisting in rigging aero wings.  
 Spot-welding projections on core plates.  
 Staining wood patterns, etc.  
 Stamping armature cores, brass, tin, etc.  
 Stenciling boxes, etc.  
 Stitching (hand) haversacks (canvas), etc.  
 Stitching (machine) aero-wing covers, leather and canvas equipment.  
 Store-keeping, tool stores, etc.  
 Straightening files, shafts, spindles, etc.  
 Stranding wire.  
 Studding tires (rubber).  
 Sulphonation for picric acid (explosives).  
 Tapping fuses, holes for rivets, nuts, tube plates, etc.  
 Teasing cotton for explosives.  
 Tempering saws, tools, wire.  
 Testing vandoliers, boiler tubes, bombs, condenser tubes, electric apparatus, instruments (scientific), mirrors (optical munitions), etc.  
 Testing, heat tests for explosives, laboratory tests for explosives.  
 Tin work, tin-plate making.  
 Tin work, flanging, guillotining, japanning, pressing, pressing seams, stamping.  
 Tool making (machine tools), various automatic and semiautomatic processes, cutting, drilling, turning, etc.  
 Tool making (small tools), various automatic and semiautomatic processes, grinding, sharpening, etc.  
 Trimming armature cores, cores (foundry), soldered and welded joints steel strips for cartridges.

## MUNITIONS WORK—continued.

II. Summary of processes—*Continued.*

Turning ball races (bearings), bar brass, boiler end plates, boiler flue flanges, bombs (howitzer), cartridge cases, cast-iron sleeves, conveyer chain links, "former" handles for machine tools, machine tool parts, motor parts, piston rings (aero engines), rod ends, shafts, spindles, studs, taps, etc.  
 Twisting electrical wire for fuses and detonators.  
 Upholstery, shipbuilding.  
 Varnishing aero-wing covers, bombs, wood patterns, etc.  
 Viewing generally, parts, and manufactured items.  
 Washing, explosives, weaving, wire for submarine nets, welding, acetylene welding.  
 Welding, general light welding on marine engine work, trench bombs (9-inch).  
 Welding, spot welding projections on core plates.  
 Wheel building (fixing spokes) for motor cycles.  
 Winding armatures (up to 100 h. p.), coils, electric motors (alternate and direct current), rotors, stators.  
 Wire, braiding, cutting for darts, stranding, tempering, twisting for electric fuses, detonators, etc., weaving for submarine nets.  
 Wire drawing.  
 Wire rope making, hemp core making and wire rope making.  
 Wiring (electrical), lighting, power, telegraph, telephone, wireless (radio-telegraph), apparatus and installations, general ship work.  
 Wiring (fastening), assisting in rigging aero wings, fastening turbine blades.  
 Woodwork (generally), boring, chamfering, countersinking, cutting, dovetailing, drilling, French polishing, gluing, painting, papering, recessing, rubbing, screwing, stenciling.

## III. Manufactured articles, parts, etc., made by women.

Acetylene lamps, soldering, riveting, and painting.

## Aeroplanes:

Engines, machining parts for aeroplanes, milling, drilling, filing, fluting, turning taps and simple fittings.

## Light wood and metal work—

Building, making, and finishing ribs, spars, and small parts.

French polishing.

Wood screwing.

Acetylene welding.

Marking gauges on cards and metal.

Cleaning, bending, and enameling metal fittings.

Filing in and marking indicator plates with wax.

Simple fitting and assembling.

Inspection.

## Wing covers—

Machining.

Stitching.

Doping.

Sizing.

Varnishing.

Putting covers on wings.

Stretching and fixing fabric.

Solution work.

Assisting in the rigging department on wire splicing.

## Ammunition. See also Explosives.

Adapters (fuse), machinery assembling, packing.

Base plugs for shrapnel, riveting, inspecting.

Bombs, 2 and 3-inch, core making, boring, drilling, turning.

Bombs, 9-inch, welding.

Bombs, cleaning, varnishing, painting, testing, inspecting.

Bullets (shrapnel), molding, casting, washing, pressing, gauging, viewing.

Cartridges (.303), all processes.

Cartridges (blasting), making and packing.

Cartridges, filling bandoliers with.

Cartridges, filling charges with.

Cartridges, grummets, in connection with cartridge manufacture.



## MUNITIONS WORK—continued.

III. Manufactured articles, parts, etc., made by women—*Continued*.

## Ammunition:

Cartridges, steel strips for trimming, oiling, and packing.

Cartridge cases, turning, buffing, gauging, rolling out dents, sizing, tapping, softening, and reforming (hydraulic process).

Detonators, twisting wire for electrical fuses and detonators.

Fuses, machining, sizing, tapping, lacquering, gauging, electro-plating, and polishing.

Fuses, electrical, twisting wire for.

Gaines, all operations in manufacture, assembling, and packing.

Grenades (hand), all operations in manufacture, assembling, examining, filling, and packing.

Shells, shrapnel, 3-inch, all operations.

H. E. shells, all machine operations, on all sizes, up to and including 9.2-inch (in some cases with assistance of special tackle for lifting 6-inch, 8-inch, 9.2-inch, in other cases with one laborer, to 5 or 10 women, to do the lifting.

Copper banding, riveting base plugs, inspecting shell cases, and containers, manufacture of.

Ammunition boxes. See Woodwork.

Ammunition carriers, canvas for four and five tenths inch stitching and making.

Armatures. See Electric motors and apparatus.

## Artillery, etc.:

Breech mechanism, all fitting on breeches of 3-inch submarine gun, breech rings, etc., of 6-inch guns, etc.

Gun sights for 4-inch, 6-inch, and 8-inch howitzers and 3 and 6 pounder naval guns.

Machine guns, machining parts, cross milling, profiling, and bench work on less intricate fitting operations.

Asbestos washers for boiler fittings.

Bags (forage), canvas, stitching and making.

Ball bearings. See Bearings.

Bands (brass), marine, polishing and turning.

Bandoliers, filling and testing.

Bars (marine), turning.

Base plugs, shrapnel. See Ammunition.

Bearings, ball and roller, fettling, drilling, grinding, sorting, turning, assembling, and viewing.

Belts (leather and canvas equipment), stitching and making.

Beveled gears (machine tools), cutting off.

Poilers (marine), shell and flue drilling.

Boiler and plates (marine), turning and drilling.

Boiler flues (marine), cutting, drilling, riveting, and turning.

Boiler tubes (marine), preparation and testing of.

Boiler tube plates (marine), tapping.

Boiler and engine fittings, dial writing, making pressure gauges, asbestos washers, etc.

Bolts, bolt making on automatic machines.

Bolt, bolt making on turret on capstan lathes.

Bolts (marine), centering and facing.

Bolts (ships), sorting, classifying, rescrowing, and cleaning.

Bolt holes (marine), facing.

Bombs. See Ammunition.

Boxes, ammunition. See Woodwork.

Boxes, hand grenades. See Woodwork.

Brasses for lathes (machine tools), milling.

Brass bands (marine), polishing and turning.

Breech mechanism. See Artillery.

Bullets. See Ammunition.

Cables, telegraph and telephone, wiring and fitting.

Cages (for ball bearings), assembling.

Cans (oil and motor spirit), stamping and cleaning.

Carbons (electric torches), rolling, shaping, and cutting.

Carbon, telephone batteries, rolling, shaping, and cutting.

Carts, water, brass pumps for, turning and painting.

## MUNITIONS WORK—continued.

III. Manufactured articles, parts, etc., made by women—*Continued.*

- Cartridges, in cartridge cases. See Ammunition.
- Castings (brass), core making, fettling, cleaning, fitting, machining, stamping, lacquering.
- Casting (marine), boring, marking, dressing.
- Chains (conveyers), turning links and recessing ends of Lincoln pins.
- Clocks (for scientific instruments), drilling, polishing, lacquering, assembling, and fitting.
- Coils, electric rotor and stator winding.
- Conveyor chains, turning parts of links.
- Cores for brass castings, filing and trimming.
- Cores in foundry.
- Cores for armatures, stamping.
- Countershafts (machine tools), fitting and assembling.
- Covers (for aeroplane wings), machining, stitching, doping, and varnishing.
- Crucibles, clay work in the making of.
- Cutters, milling teeth in (machine tools).
- Dials (engine fittings and pressure gauges), writing and marking.
- Dynamometer bars, papering and smoothing.
- Electric apparatus, motors, etc.:
  - Ammeters, making.
  - Armatures, stamping and winding.
  - Batteries (telephone), finishing and packing.
  - Batteries (motor cycle), polishing and packing.
  - Brush rockers (brass), filing and assembling.
  - Cable covering.
  - Cable insulating.
  - Carbons, rolling, shaping, and fitting.
  - Coil, rotor and stator winding.
  - Fuses, electrical wire for.
  - Gear, filling and assembling.
  - Generators, filing and trimming cores.
  - Meter, shop work.
  - Motor (alternate and direct current), forming and winding.
  - Painting, motor parts.
  - Plating and dipping.
  - Test room work.
  - Torches (electric), cutting carbons for.
  - Transformers, manufacture of.
  - Switches (electric), assembling.
  - Switch gear, polishing.
  - Voltmeters, making of.
  - Wire, electrical, for fuses.
- Engine fittings. See Boiler fittings.
- Explosives:
  - Abelite, drying, grinding, mixing, cartridging, packing.
  - Ballistite, mixing, pressing, and sifting of paste; drying incorporating, rolling into sheets, cutting into cubes; sifting, drying, and packing cubes.
  - Collodion cotton, picking, teasing, drying raw cotton, boiling, pulping, centrifuging, pressing, and drying nitrated cotton.
  - Cordite, mixing and sifting for paste, pressing into cords and strands, blending, reeling, drying, and packing.
  - Gun cotton, same process as collodion cotton and also dipping for nitration.
  - Nitric acid, charging and firing retorts.
  - Phenol, synthetic production from benzol.
  - Picric acid, sulphonation and nitration of phenol, washing, whizzing, working up of crust, drying, sifting, and packing of picric acid.
  - T. N. T., nitration, washing, pelleting, drying, flaking, and packing.
- Miscellaneous work, routine tests in laboratories, heat tests, micrometer work, making wooden cases, filling tins and cases, nailing or screwing down cases, stenciling, washing, filling, sealing, weighing and loading carboys, transport work, including teaming horses.
- Files, cutting, branding, straightening, dry grinding, viewing, and packing.

## MUNITIONS WORK—continued.

III. Manufactured articles, parts, etc., made by women—*Continued.*

- Flanges (marine), facing.
- Flues (marine), drilling, riveting, and turning.
- Forage bags (canvas), stitching and making.
- Forging (marine), boring holes in.
- Forms (wooden), training, screwing, assembling, and finishing.
- Fracture boards, boring.
- Fret saws, hardening and tempering.
- Friction rings (machine tools), internal grinding.
- Fuses and fuse adapters. See Ammunition.
- Gaines. See Ammunition.
- Gauges (pressure), manufacture of.
- Gears (beveled), helical and spur (machine tools), cutting of.
- Gear cases (for motor cycles), assembling, finishing, and packing.
- Glass slitting. See Optical munitions.
- Gratings (ships), making of.
- Grenades. See Ammunition.
- Grummets (for cartridge making). See Ammunition.
- Gun sights. See Artillery.
- Handles, former (for machine tools), turning.
- Handles (for motor cycles), scouring, scraping, enameling, polishing, inspecting, and packing.
- Handles for swords (vulcanized rubber), buffing, rubbing, shellacking, and polishing.
- Harness, cavalry and gun teams, manufacture of.
- Haversack (canvas), hand stitching of.
- Helical gears (machine tools), cutting.
- Hemp core for wire rope.
- Hinges (doors and scuttles), ship, fitting and machining.
- Horseshoes, drilling.
- Instruments. See Scientific instruments and optical munitions.
- Kits (leather and canvas), manufacture of.
- Ladders (ships), making of.
- Lamps (acetylene), soldering, riveting, and painting.
- Leather and canvas goods (manufacture of equipment, belts, pouches, harness) for cavalry and gun teams, handstitching haversacks, and 4.5-inch ammunition carriers.
- Lenses. See Optical munitions.
- Lincoln pins for conveyor chains, recessing ends of.
- Liners (marine), grinding.
- Machine guns. See Artillery.
- Machine tools:
  - Brackets (cast-iron), drilling.
  - Countershafts, fitting and assembling of.
  - Cutters, milling teeth in.
  - Friction rings, internal grinding of.
  - Gears (bevel), spur and helical, turning, cutting, and shaping of.
  - Lathes, turret, cutting bars for.
  - Lathes, brass, milling.
  - Nuts, grinding of.
  - Pulleys, turning on 15-inch center chucking lathe.
  - Rings, friction, internal grinding of.
  - Shafts, turning and milling of.
  - Sleeves, turning.
  - Side rests, fitting.
  - Spindles, boring.
  - Turrets (square), milling.
  - Wheel blanks, boring.
- Marine engineering:
  - Bands (brass), polishing.
  - Band saw, sharpening.
  - Bars, turning.
  - Boilers, shell and flue drilling.
  - Boiler end plates, turning and drilling.



## MUNITIONS WORK—continued.

III. Manufactured articles, parts, etc., made by women—*Continued.*

- Boiler flues, cutting, drilling, riveting, turning.
- Boiler tubes, preparation and testing of.
- Boiler-tube plates, tapping.
- Bolts, centering and facing.
- Bolt holes, facing.
- Castings, boring, marking, and dressing.
- Core making.
- Flanges, facing up to a plate.
- Flues, drilling, riveting, and turning.
- Forgings, boring holes in.
- Liners, grinding of.
- Nuts, centering, tapping, facing, cleaning, rescrowing, classifying, and sorting.
- Pipes, facing of.
- Plates, turning, planing, drilling, tapping, spot welding.
- Rods, turning and cutting.
- Spindles, turning of.
- Studs, turning of.
- Tubes, bending, cutting, welding, testing.
- Turbines, machining, etc., balding, caulking, wiring.
- Mess tins, pressing and cleaning.
- Mica, cutting.
- Mirrors, blocking, testing, and silvering.
- Motors. See Aeroplane engines, electric motors, and motor cycles.
- Motor cycles and accessories:
  - Batteries, finishing, inspecting, and packing.
  - Gear cases, assembling.
  - Handles, scouring, scraping, enameling, polishing, inspecting, and packing.
  - Mud guards, enameling, polishing, screwing, inspecting, and packing.
  - Shafts, straightening of.
  - Wheels, building of (fixing spokes).
- Motor spirit cans, stamping seals for.
- Mud guards, enameling, polishing, screwing, inspecting, packing.
- Munitions cases. See Woodwork.
- Netting wire (submarine), weaving of.
- Nuts, bolts, and washers, manufacture of, on capstan or turret machine; also (marine) centering, tapping, facing, cleaning, rescrowing, classifying, and sorting.
- Oil cans, press stamping.
- Optical munitions:
  - Glass slitting.
  - Lenses, ruffing, smoothing, polishing, edging, shanking, and chamfering, cementing, and centering.
  - Prism, blocking, testing, silvering, mirrors.
  - Patterns, wood (ship's), filling, coloring, varnishing, and sandpapering.
  - Pipes (marine), facing of.
  - Pipes (ship), making rubber joints for.
  - Plates (marine), turning, planing, drilling, tapping, spot welding.
  - Pouches (leather and canvas), manufacture of.
  - Pressure gauges, manufacture of.
  - Prisms. See Optical munitions.
  - Pulleys (machine tools), turning.
  - Pumps (brass), for water carts.
  - Pumps (motor cycle), polishing, drilling, packing.
  - Races (for ball bearings), turning and grinding.
  - Rails (ship's), fitting and machining.
  - Respirators, making and soldering.
  - Ribs (aeroplane), making and finishing.
  - Rings, friction (machine tools), grinding.
  - Rivets (ship's), sorting and heating.
  - Rods (marine), turning and cutting.
  - Roller bearings. See Bearings.
  - Ropes, making hemp core for wire ropes.
  - Ropes, making steel wire ropes.

## MUNITIONS WORK—continued.

III. Manufactured articles, parts, etc., made by women—*Continued.*

## Rubber:

- Studs (tire), manufacture of.
- Sword handles (vulcanized rubber), buffing, rubbing, shellacking, polishing.
- Tires, studding, and casing.
- Rubber joints for pipes (ship).
- Scientific instruments, drilling, polishing, lacquering, assembling, and fitting clocks for coil winding and engraving.
- Sea planes. See Aeroplanes.
- Shafts (machine tools), turning and milling.
- Shells, shell cases, etc. See Ammunition.
- Sleeves (machine tools), turning.
- Slide rests (machine tools), scraping and fitting.
- Spars (aeroplane), finishing.
- Spindles (machine tools), boring.
- Spokes (motor cycle), fixing of (wheel building).
- Spur gears (machine tools), cutting of.
- Stanchions (ship), fitting and machine.
- Stays (ship), fitting and machining of.
- Studs (marine), turning of.
- Studs (tire), manufacture of.
- Switches (electric), assembling.
- Switch gear, polishing.
- Sword handles (vulcanite rubber), buffing, rubbing, shellacking, and polishing of.
- Taps, milling, turning, filing, and sharpening.
- Telegraph switch gear, wiring and fitting. See also Wireless telegraph apparatus.
- Telephones (carbons for), rolling, shaping, and cutting.
- Telephones (switch gear), polishing.
- Telephones, wiring and fitting of.

## Tin work:

- Tin-plate manufacture.
- Press work, japanning, etc.
- Pressing seams on mess tins.
- Press stamping oil cans, seals for motor spirit cans.
- Making, soldering tin boxes for grenade fuses.

## Toolmaking:

- Grinding saws, milling-machine cutters, and other tools.
- Grinding twist drills to size.
- Milling teeth in side and face cutter.
- Milling, fluting, turning and sharpening taps.
- Producing double-angle cutters.
- Turning "former" handles for machine tools.
- Slot milling (special machine) on shell-boring lathes.
- Backing-off lathes producing form cutters.

## Tools. See Machine tool making and small tool making.

## Torches (electric), rolling, shaping, and cutting carbons.

## Transformer (electric), manufacture of.

## Tube plates, boiler (marine), tapping.

## Tubes (brass), press and capstan hands on.

## Tubes, acetylene welding of 18 gauge.

## Turbine blades, drilling, milling, boring, cutting, wiring, and brazing.

## Turbine rotors, blading.

## Turbine stators, blading.

## Turrets for lathes (machine tools), turning and milling.

## Tires. See Rubber.

## Vises (saddle tree), all operations except assembling.

## Volt meter, making of.

## Vulcanized rubber sword handles, buffing, rubbing, shellacking, and polishing of.

## Washers (asbestos), for boiler fittings, pressure gauges.

## Washers (metal), making of.

## Water carts (army), brass pumps for.

## Field blanks (machine tools), turning and boring.

## Wheels (motor cycle), building of.

## MUNITIONS WORK—continued.

III. Manufactured articles, parts, etc., made by women—*Continued.*

Wing covers (aeroplanes), machining, stitching, doping, sizing, and varnishing.

Wire, electrical.

Wire rope, making of, braiding, stranding, cutting, tempering, drawing.

Wire netting (submarines), weaving of, twisting for fuses and detonators.

Wireless telegraph apparatus, lacquering, polishing, staining, plating, dipping, engraving, and assembling.

Wire, winding.

Woodwork:

Aeroplane ribs, spars, etc.

Boxes (hand grenade), all processes.

Boxes (18 pr. ammunition), all processes.

Boxes (spare part and tool), for Vickers' guns.

Cases (for explosives), making, painting, stenciling, etc.

Dynamometer bars.

Forms (soldiers' collapsible), training, screwing, etc.

Fracture boards.

Joinery (shipbuilding), assisting at saw, etc.

Joinery (shipbuilding), upholstery.

Patterns, coloring, varnishing, sandpapering.

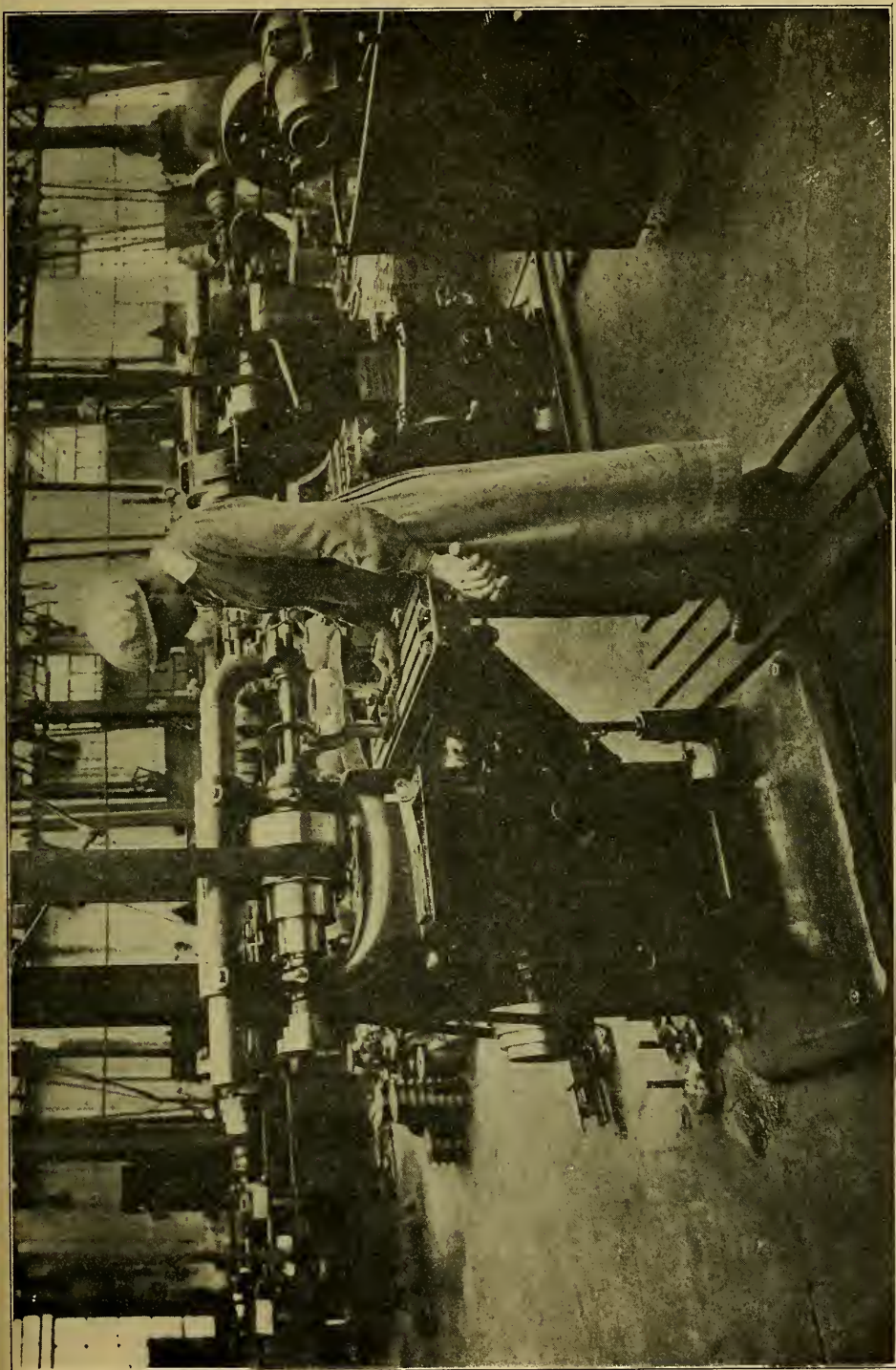
Shell cases and containers, manufacture of.



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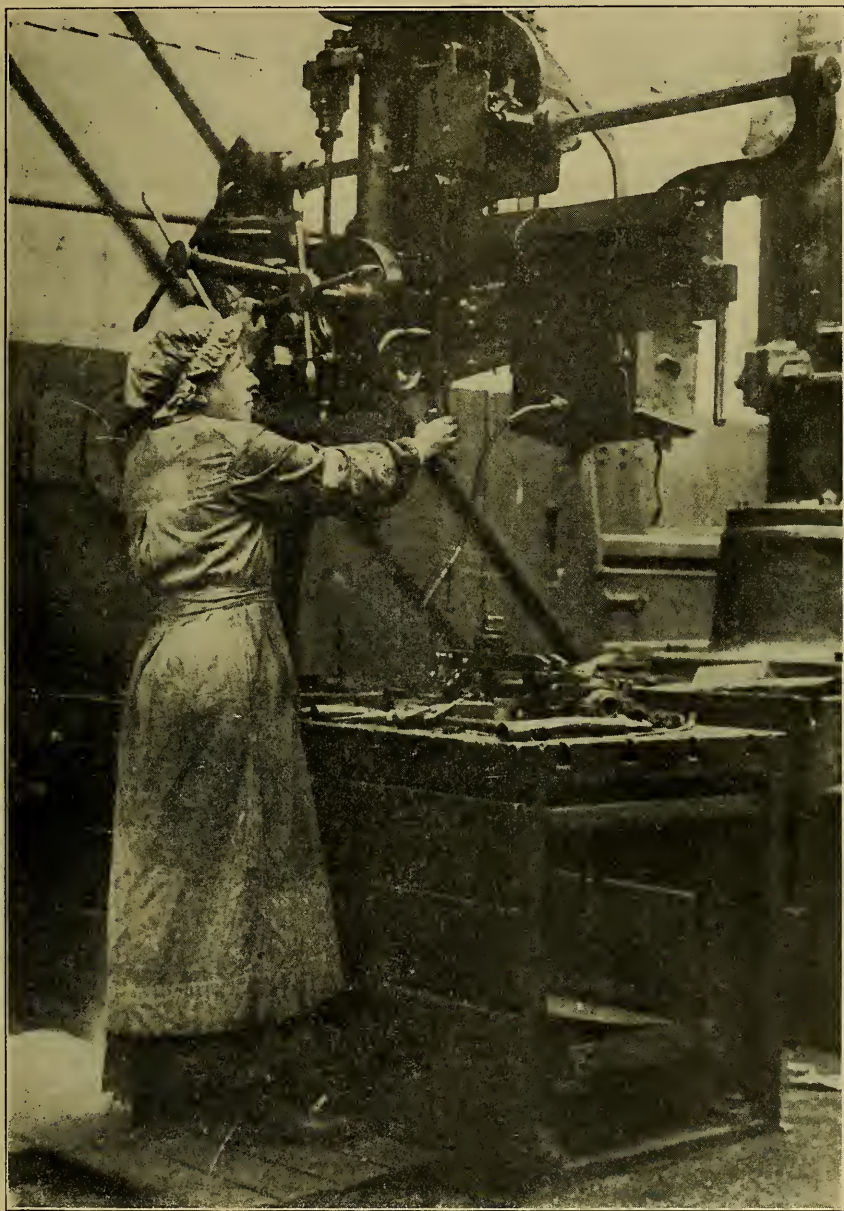
**MILLING BRIDGE FOR VALVE CHEST**  
(John Brown & Co., Ltd., Clydebank)



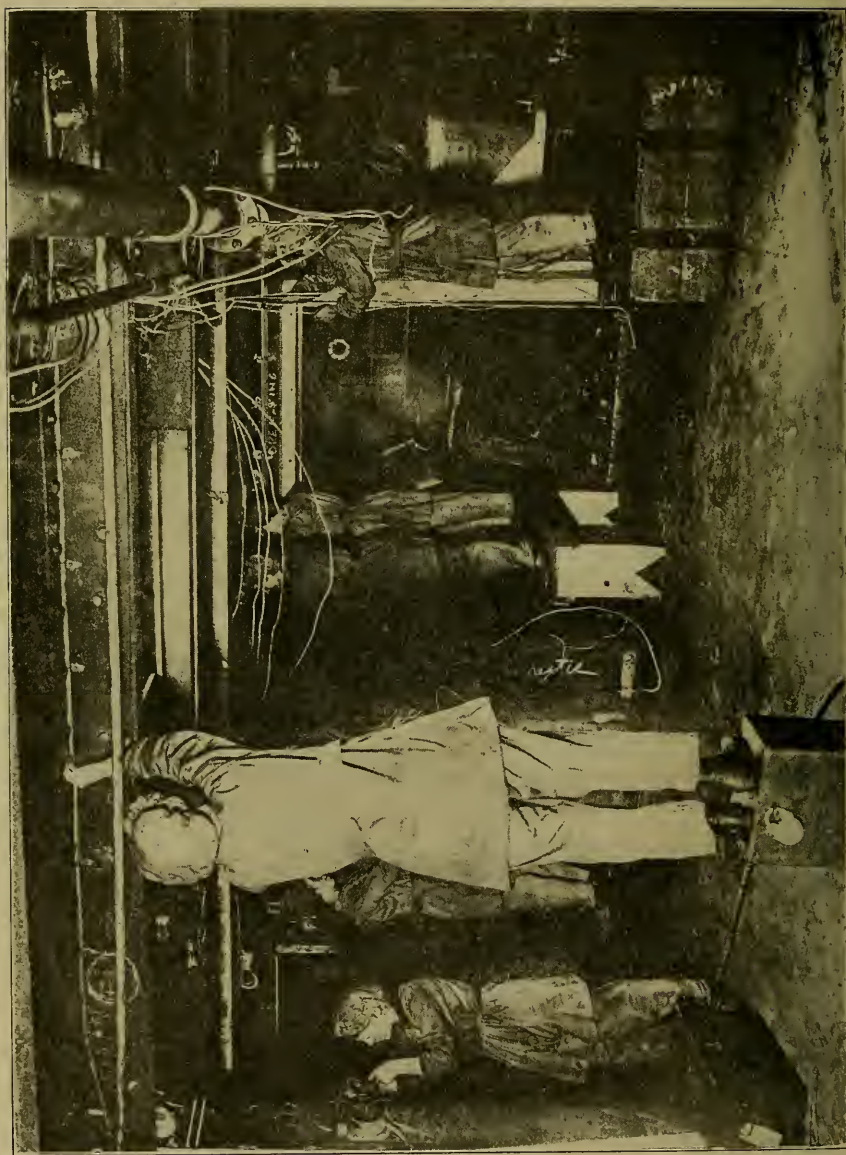
**WHAT THE DAUGHTERS OF BRITAIN ARE DOING**

Woman operating boring machine; boring wooden reels for winding barbed wire.  
(British official photograph)





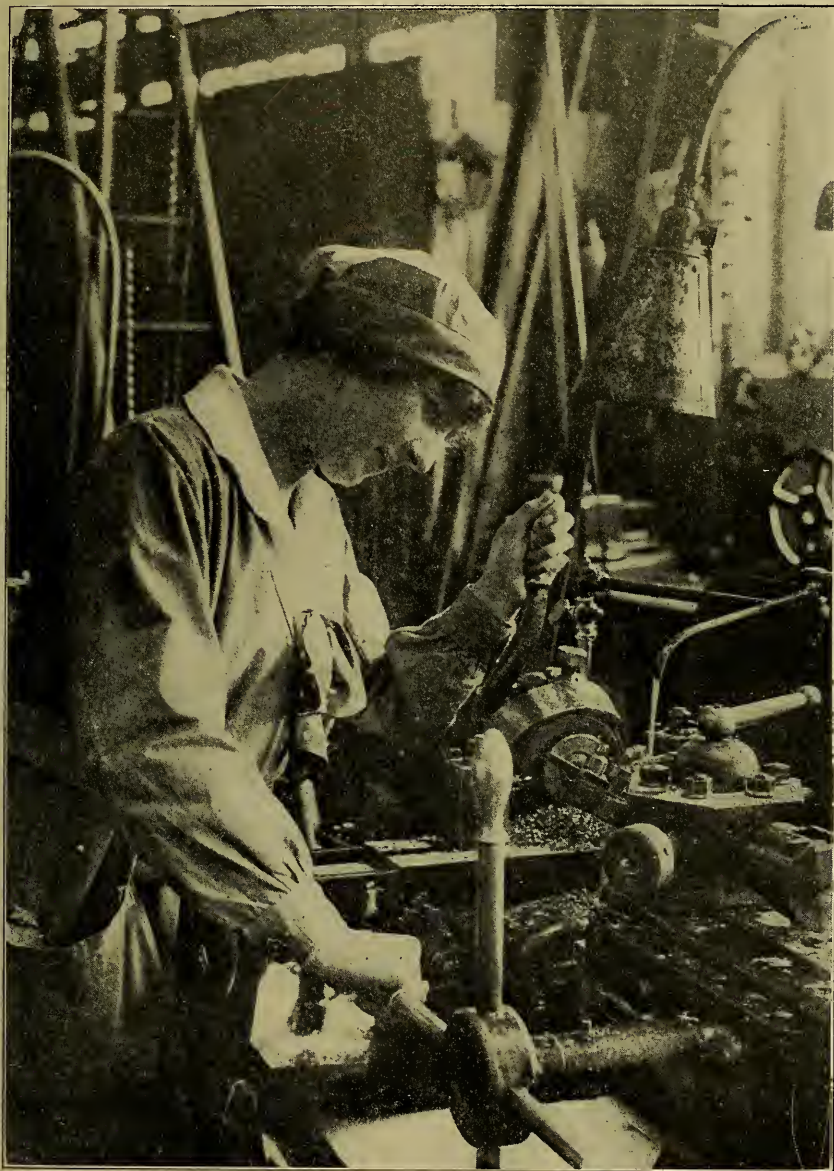
GIRL WORKING ON DRILLING MACHINE IN NAVAL WORKSHOP  
(Walkend yard of Messrs. Swan, Humber and Wigham Richardson)



**WHAT THE DAUGHTERS OF BRITAIN ARE DOING**

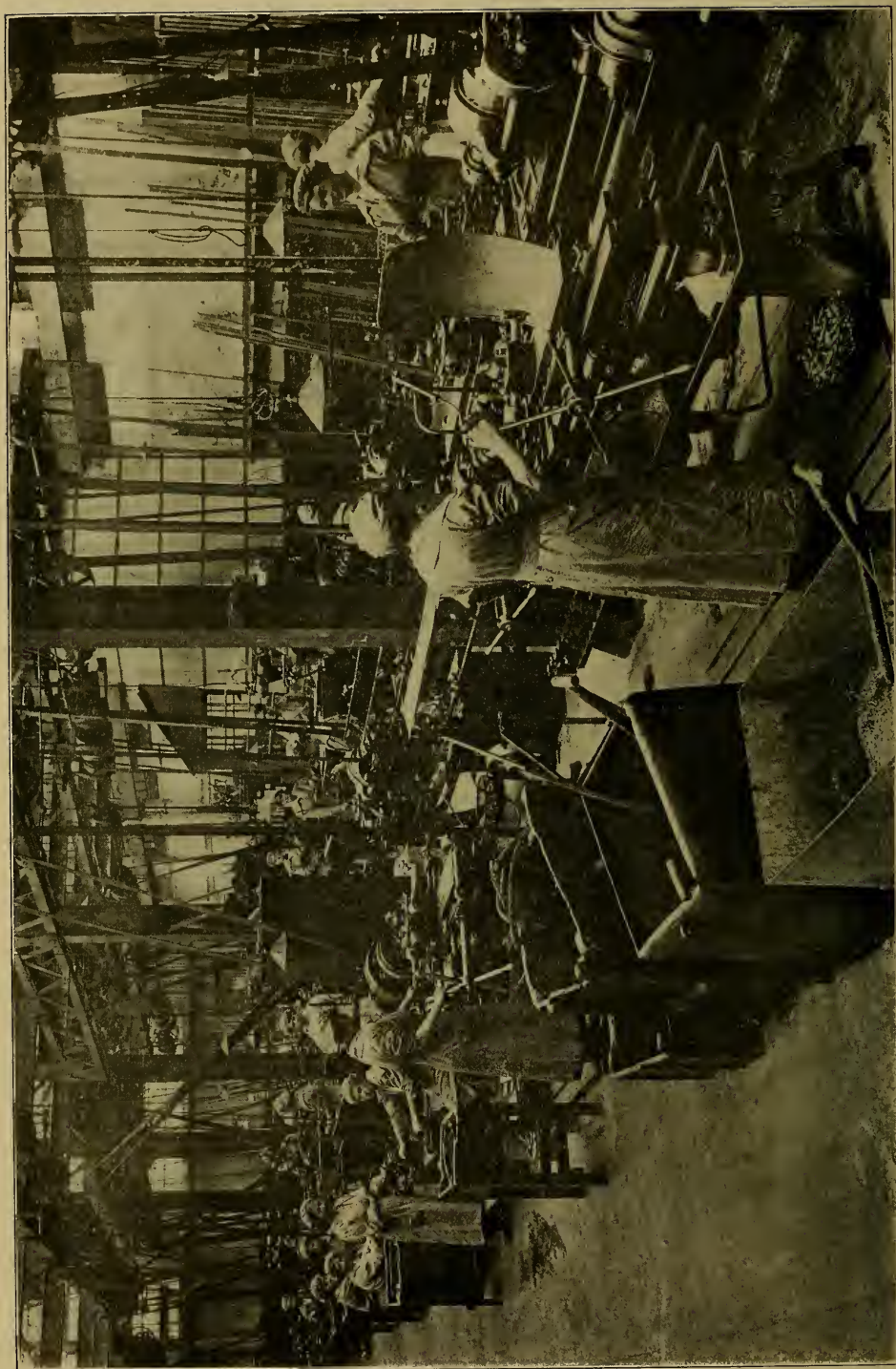
Women electrical wiring on board a British battleship. (British official photograph)



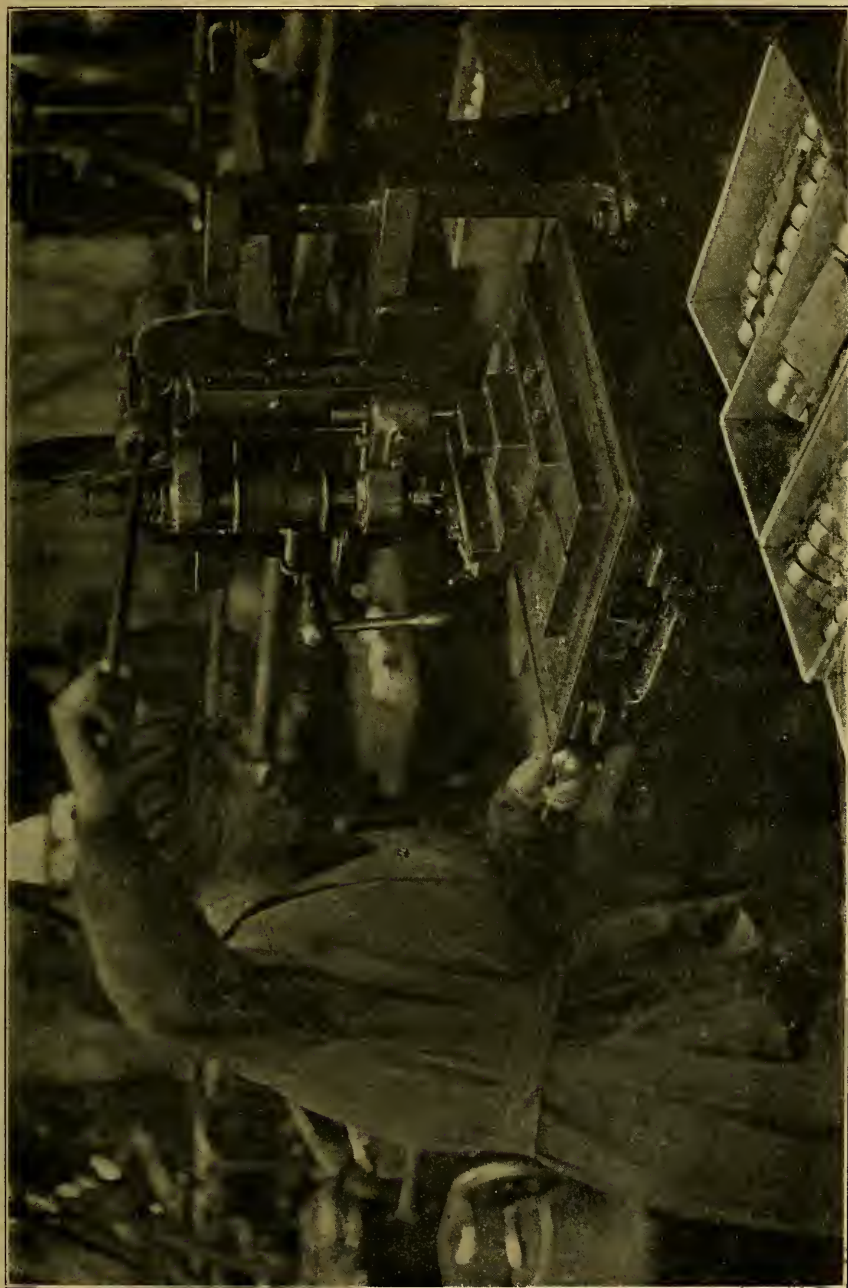


WORKING A CAPSTAN TURNING MACHINE  
(Naval yards of the Tyne)



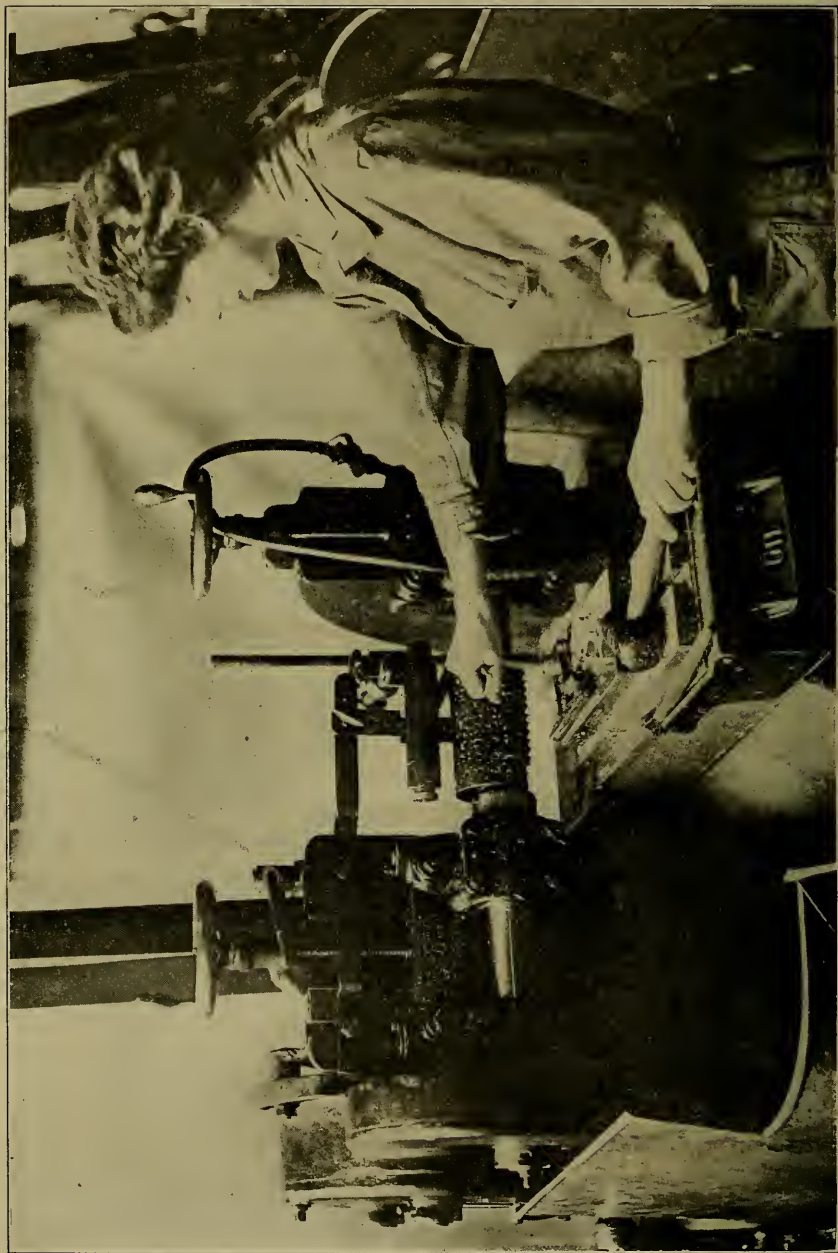


BLADE MACHINING DEPARTMENT  
(John Brown & Co., Ltd., Clydebank)



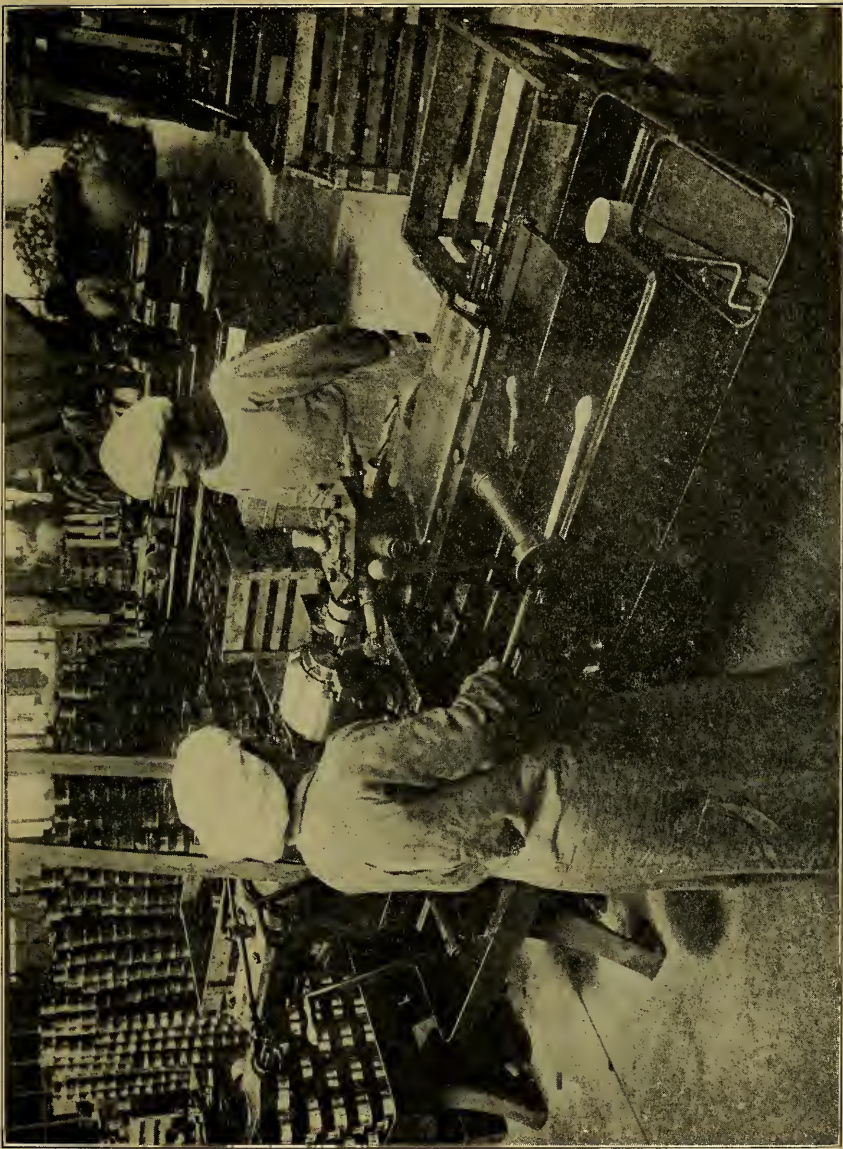
PROFILING ROUND CORNERS AND SIDES OF MACHINE GUN COMPONENT



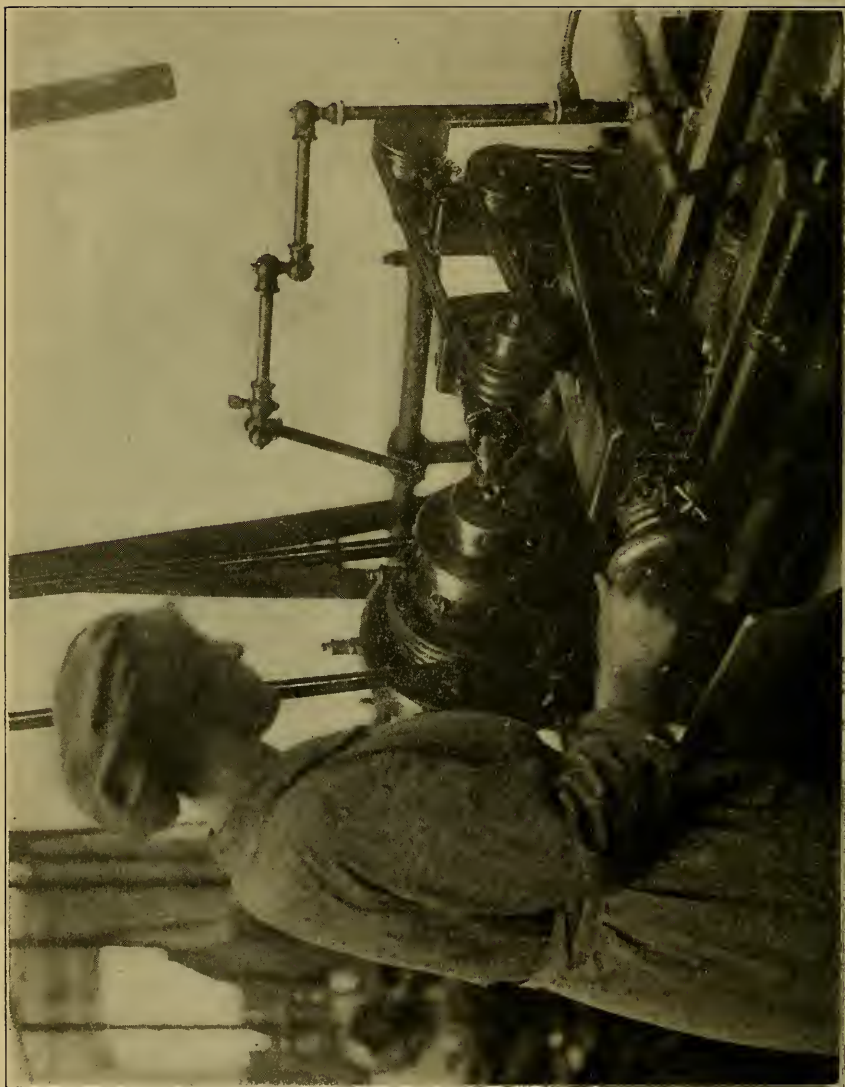


CROSS MILLING SIDE FACES OF TRIGGER GUARD FOR LEWIS AUTOMATIC GUN

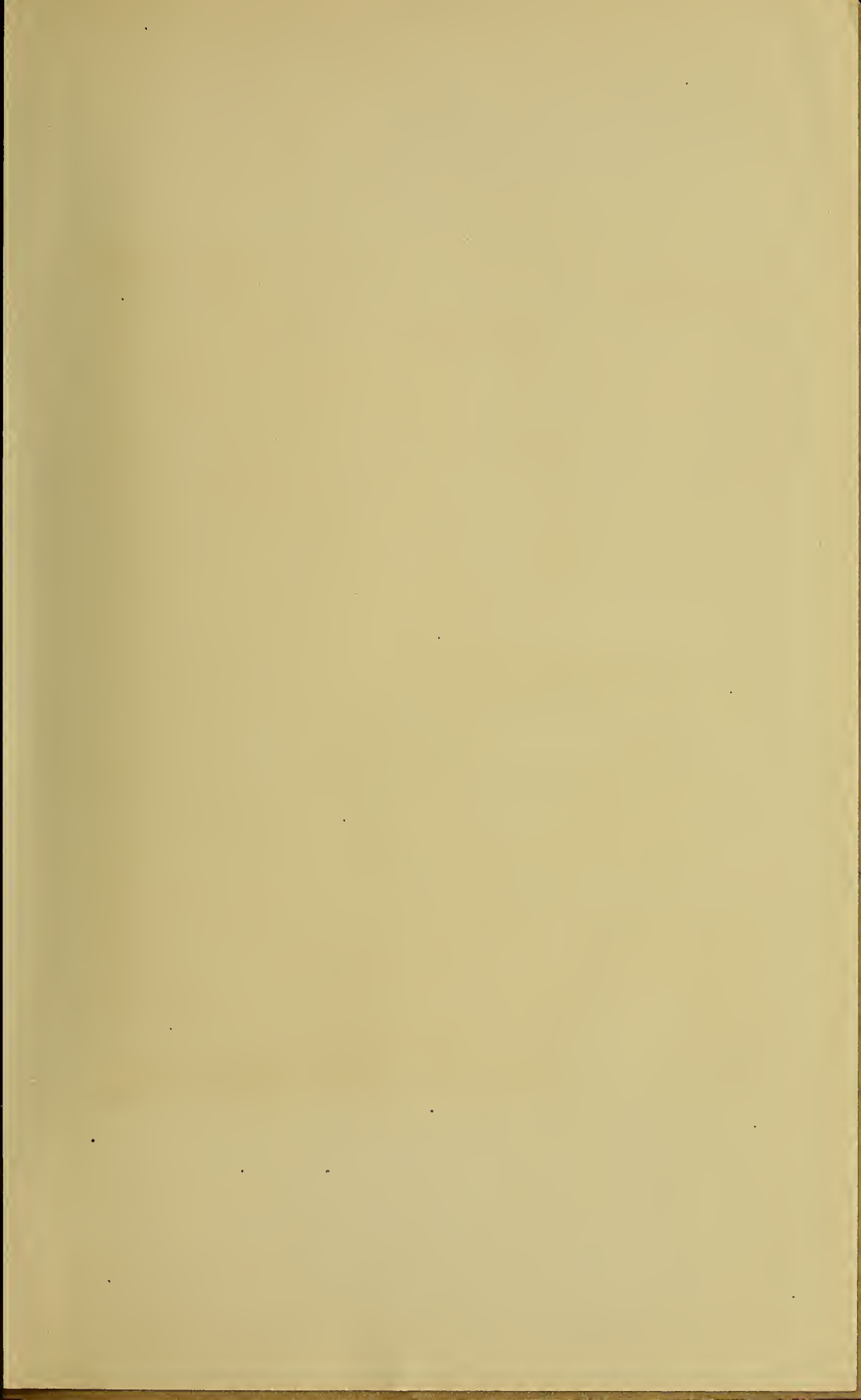




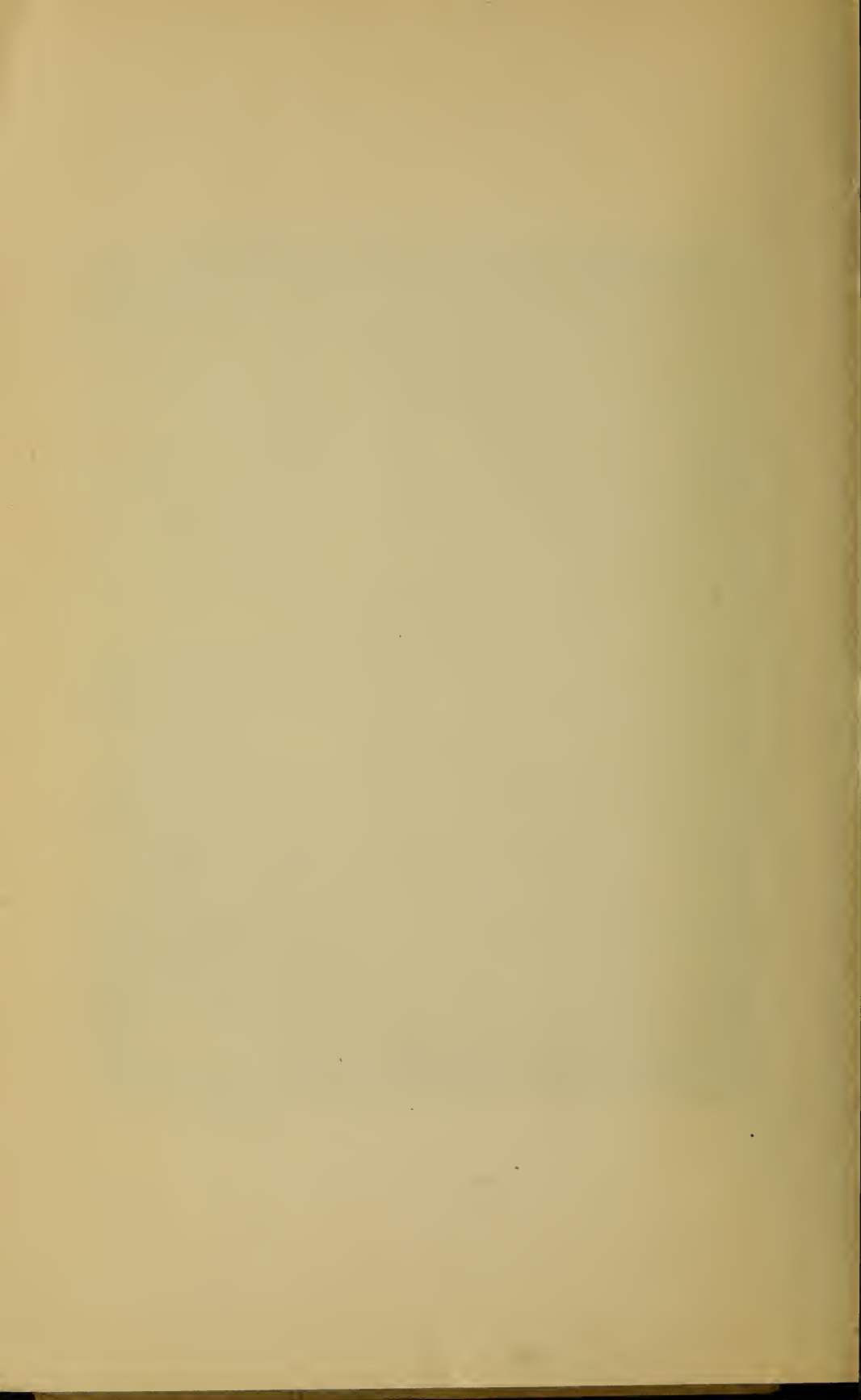
WOMEN OPERATING WARNER AND SWASEY CAPSTAN LATHES MACHINING HEADS OF 4.5"  
CARTRIDGE CASES

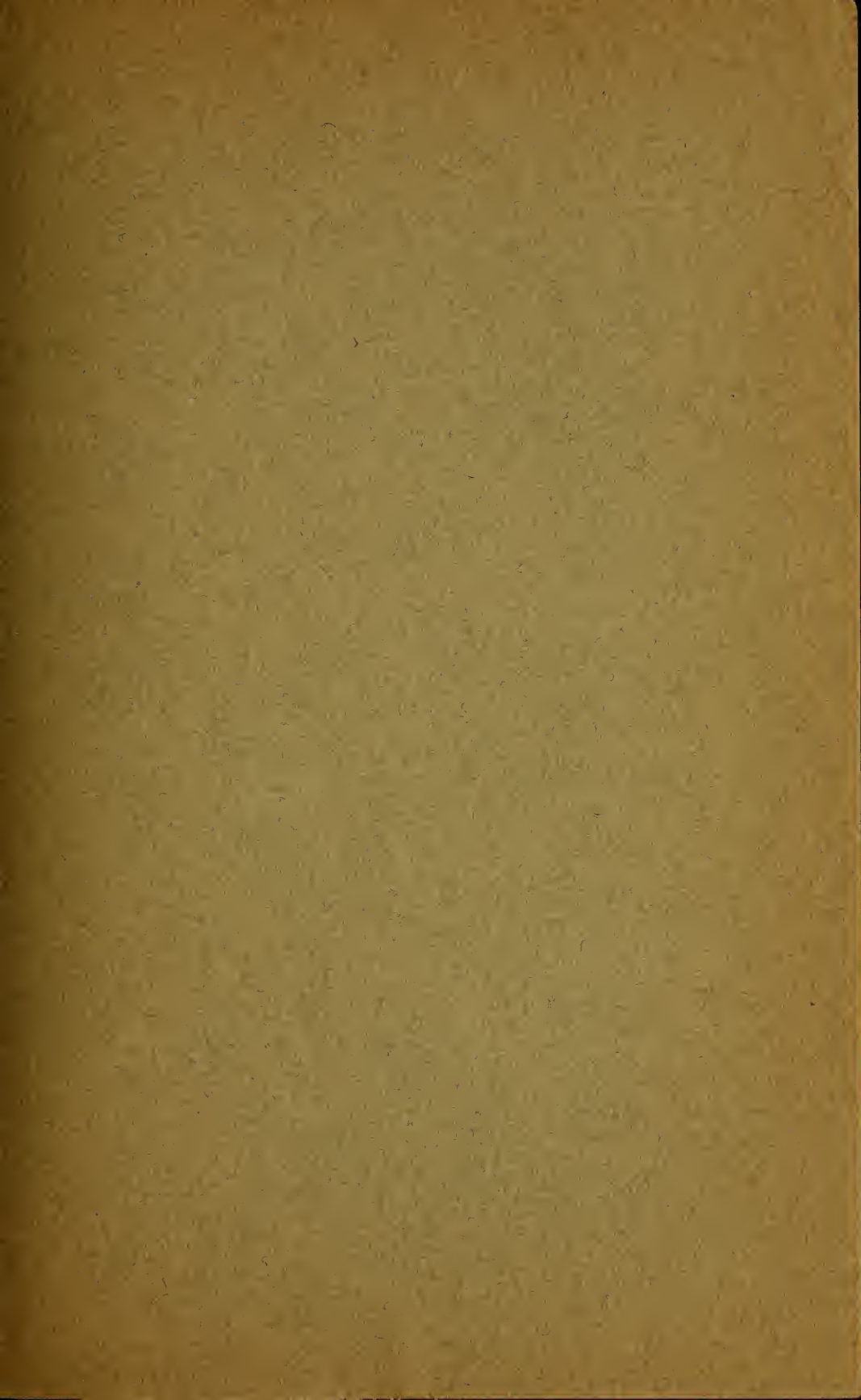


THREAD MILLING MACHINE GUN COMPONENT









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